the OIL AND GAS JOURNAL

MAY 7, 1956

Esso Adds Super Gasoline

100-plus product will make a third grade; is it now a trend?

p. 80

New Field Process May Rescue West Texas Sour-Crude Producers

p. 84

How to Perforate Your Well to Prevent Water and Gas Coning

p. 108

Process-Type Instruments Applied to Refinery Boilers • p. 115

Why Automatic Lubrication Keeps Mission Plug Valves Young

In Mission Plug Valves, lubricant acts like plastic packing to form a gas-tight seal that can be renewed without disturbing production. The Automatic Lubrication system keeps this lubricant under line pressure to stop leaks — automatically — before they start! That is why Mission Plug Valves can be unconditionally guaranteed to outperform any other valves in their pressure range in the service for which they were designed.

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A Glance Ahead . . . . at press time

These trends will make TOMORROW'S NEWS

Interest in Cuban oil exploration remains high although the island is still waiting for its first big discovery. Superior Oil Co. is reported to have purchased 200,000 shares in Cuban American Drilling & Exploration Co., Dallas, which recently found a promising gas zone near Jatibonico oil fields.

Tide Water and Phillips are reported looking for a chance to enter the Cuban play. Deals being talked would give them an interest in established concessions in return for fulfilling drilling commitments.

Imperial Oil, Ltd., looks for total demand for Canadian crude oil to double by the early 1960's. The brightening outlook has caused the company to boost its predictions of last fall by 20 per cent. The number of Canadian vehicles is expected to increase by 50 per cent by the early 1960's, and added crude requirements for this rising domestic market will be augmented by an anticipated rise in exports to the U. S.

Look for a new hydrogen-treating process to make its bow, possibly this summer. It is said to be able to handle various crude fractions as well as whole crude and bottoms.

Interest is building for crude hydrodesulfurization ahead of the crude stills in refineries, or in the field itself. Many operators will be watching the Varel project (page 84) with interest. This first crude upgrading program may have additional takers before the year is out.

Lack of readily available steel is pinching the industry especially hard along the Gulf Coast.

Refiners say that some projects under way are being stretched out an extra quarter due to delays in getting steel. Line pipe 6-in. and smaller is difficult to get except in small lots. And builders for the offshore oil industry are faced with a booming demand and not enough steel with which to build the equipment.

One with three platforms under way wants to build a fourth, but hasn't the steel. No relief is in sight until October, he's been told. High cost of offshore equipment precludes foreign steel or premium prices. A penny-a-pound premium, for example, would mean an $80,000 increase in a 4,000-ton drilling-barge hull alone.

The long-rumored purchase by Gulf Oil Corp. of British-American Oil Producing Co. will not take place. For several reasons, Gulf has decided not to make the move.

Isobutane deasphalting is coming into the picture. Planned for a major West Coast refinery, it is said to have an advantage over propane deasphalting in reducing capital costs in compression facilities. Meanwhile, propane-butane deasphalting is being adopted in new plants and the whole concept of decarbonizing crude bottoms for cat cracker feed is of current interest to several refiners.

the OIL AND GAS JOURNAL

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THE STAFF

TULSA OFFICE
211 South Cheyenne Ave.
Phone Diamond 3-6291

Kenneth B. Barnes ... Editor
Henry D. Ralph ... Chief Editorial Writer
Ted A. Armstrong ... News Editor
Gerald L. Farrar ... Engineering Editor
Dr. Frank J. Gardner ... Exploration Editor
Paul Reed ... Pipeline Editor
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LaWanda Turner ... Readership Research
Helen Brown ... Editorial Assistant
Alice Burt ... Editorial Assistant
Aileen Cantrell ... Editorial Assistant
C. Dudley Johnston ... Art Director
Jo Jeanne Speaker ... Staff Artist

NEW YORK OFFICE
500 Fifth Avenue
Phone LOngacre 4-6160

George H. Weber ... Refining Editor
Paul Swain ... International Editor
Ray G. Gibson ... District Editor

HOUSTON OFFICE
802 Sterling Building
Phone CApitol 4-7726

Larry Resen ... District Editor
Ed McGhee ... District Editor
Joe Reilly ... District Editor

DALLAS OFFICE
1238 Mercantile Bank Building
Phone STerling 3074

Robert J. Enright ... District Editor

LOS ANGELES OFFICE
650 South Grand Avenue
Phone VAndike 0722

D. H. Stormont ... District Editor
William T. Smith ... District Editor

WASHINGTON OFFICE
621 Albee Building
Phone District 7-1710

Bertram F. Linz ... District Editor

Correspondents at Denver, Pittsburgh, Calgary, Columbus, Ashland, Ky., Oil City, Pa., Mount Pleasant, Mich., Melbourne, Australia; Regina, Sask.; Chatham, Ont.; Casper, Wyo., and Anchorage, Alaska.

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OIL AND GAS PIPELINES • REFINING • PETROCHEMICALS
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TECHNOLOGY—OPERATION

Pipelining

How T.G.T. Cuts Operating Costs **119**

By O. H. Moore

The company has improved pipeline compressor techniques by supercharging to increase engine horsepower, scavenger air cooling, higher compressor ratios, improved station piping, and better selection of compressor cylinders with regard to clearance volumes.

Pipeline Patrol: Safety in Oil Tank Cleaning **157**

By Jack E. McGuire

The first step in this important activity is that of safe job planning. A careful supervisor sees to it that all personnel know exactly how the job is to be done. No item should be thought too small to consider.

Drilling—Production

Perforating to Prevent Water and Gas Coning **108**

By P. E. Cheney, M. D. Noble, W. L. Henson, and J. D. Rice

This article presents the results of a study of water and gas coning. A set of curves is presented by which maximum water-free or gas-free oil production rates can be determined for wells having a gas-oil contact, water-oil contact, or both. The study is limited to the coning problem and does not attempt to deal with problems related to water and gas fingering. Seven main conclusions are presented.

Williston Basin Dominates Rockies Drilling **125**

By John C. McCaslin

This summary of Rocky Mountain operations was compiled by the Journal's exploration department using a new and experimental punch card system. It covers a seven-state area.

Indexing Sub Reveals Effect of Bit Hydraulics **130**

By R. J. Bromell

The preliminary results of a study by the A.P.I. Southwestern District study committee on jet bit drilling. Recommendations cover the effect of bit horsepower at high and low drilling rates, effect of rotary speed, and ways to reduce parasite loads in the circulation system.

Here's a Fast Way to Seal Water-Storage Ponds **136**

By Al Gaston

Open ponds for water-flooding and other production operations can be lined with prefabricated asphalt membrane to prevent the loss of water due to seepage and to prevent pollution where salt water is involved.

Refining—Processing

How to Instrument Refinery Boilers **115**

By Robert Silva

There is a trend toward process-type instruments in processing steam plants. These instruments are more highly developed, more dimensionally compact, and require less space on central control panels. They can be maintained with reduced inventories of parts and supplies and usually they cost less.

Costimating **147**

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Exploration

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Selected digests of papers presented at the joint meeting of the A.A.P.G. and S.E.P.M. in Chicago, April 23-26.

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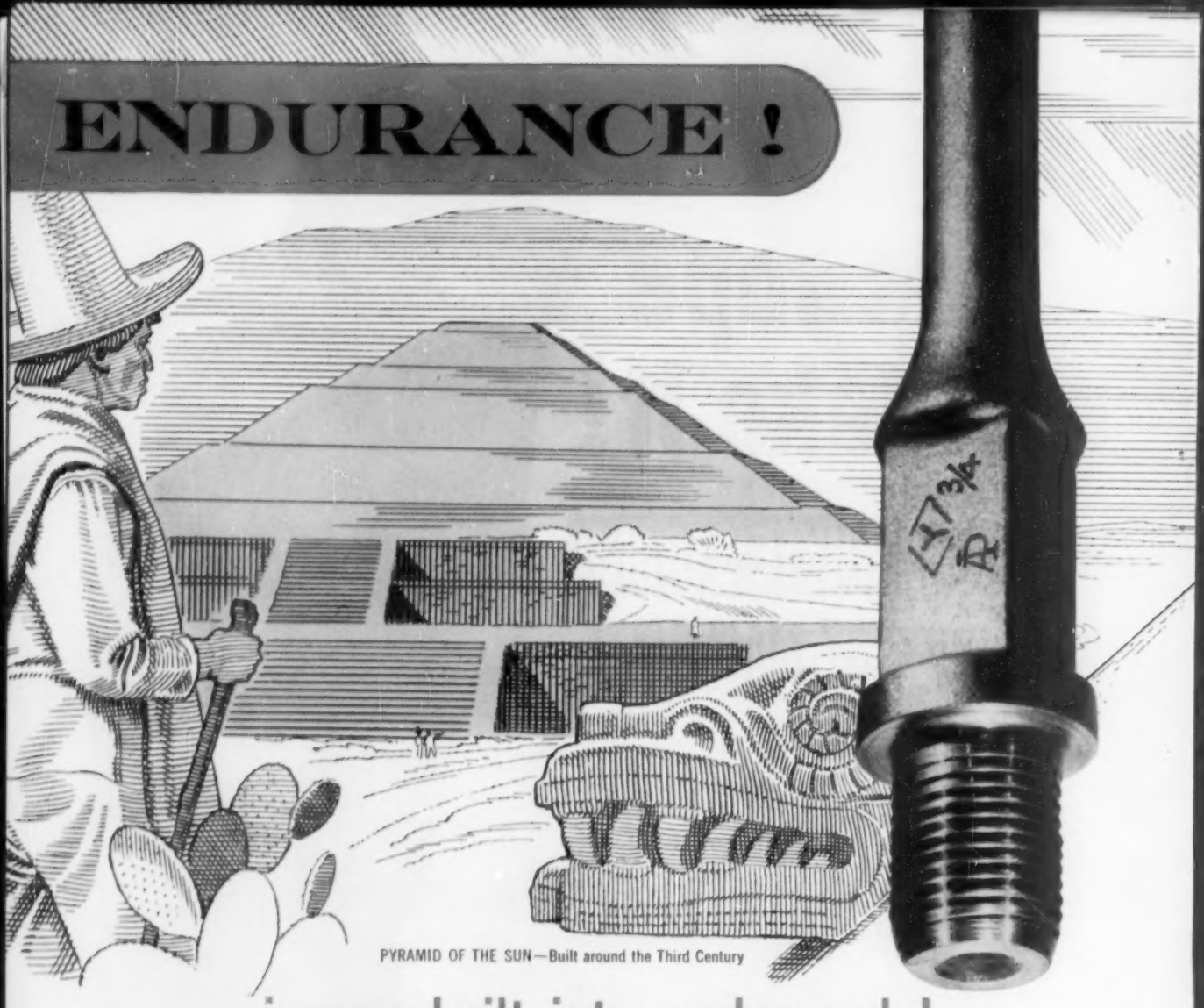

PYRAMID OF THE SUN—Built around the Third Century

. . . is now built into sucker rods!

THE DEEPER you have to go to get production, the more you should know about the remarkable properties of a special new steel which United States Steel research engineers have developed.

After extensive laboratory tests, a special combination of alloying elements, including boron, was found to produce a steel of exceptional toughness and strength when the complete heat treatment with LIQUID QUENCHING and tempering was employed. Steel with greater resistance to fatigue was thus made available to industry.

While researchers were exploring its unique properties in numerous other fields, "Oilwell" produced several strings of sucker rods from this tough-strong steel to conduct a number of field tests. The following one is typical:

In April, 1952, three strings were run below 6,900 feet by Sohio Petroleum Company in the West Edmond Field near Edmond, Oklahoma. Loading varied from 25,000 to 30,000 pounds per square inch. Approximately four years later *all three strings* are still in operation.

The fatigue-resistant properties of this new steel have been fully utilized and stabilized with "Oilwell's" modern and complete heat treating facilities, and sucker rods of this new steel are now on *regular production*. They are known as Grade "Y" rods, and numerous companies are specifying them for deep wells where they are proving far superior to anything previously used. They work longer under heavy loads without failure.

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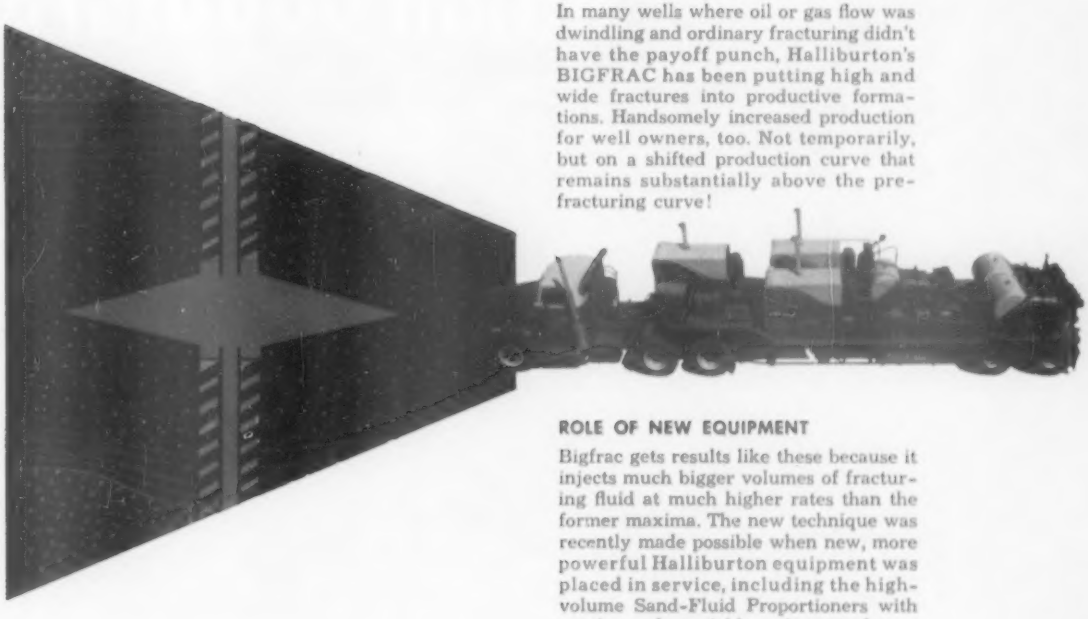

In many wells where oil or gas flow was dwindling and ordinary fracturing didn't have the payoff punch, Halliburton's BIGFRAC has been putting high and wide fractures into productive formations. Handsomely increased production for well owners, too. Not temporarily, but on a shifted production curve that remains substantially above the pre-fracturing curve!

ROLE OF NEW EQUIPMENT

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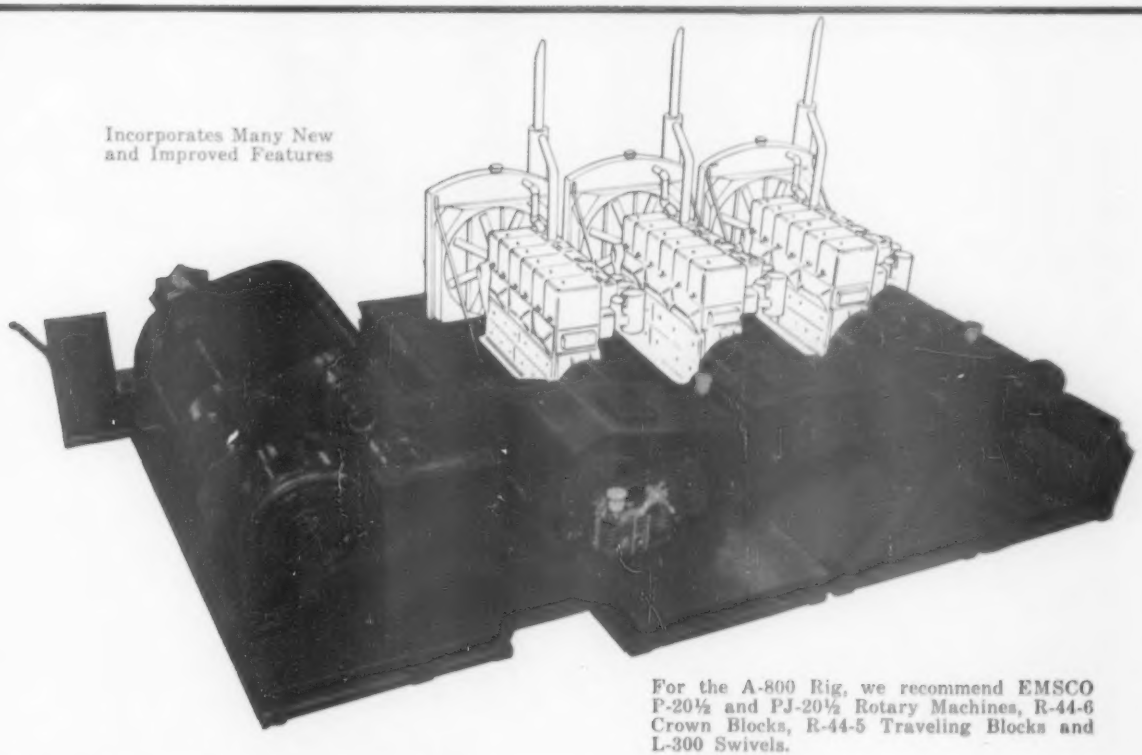

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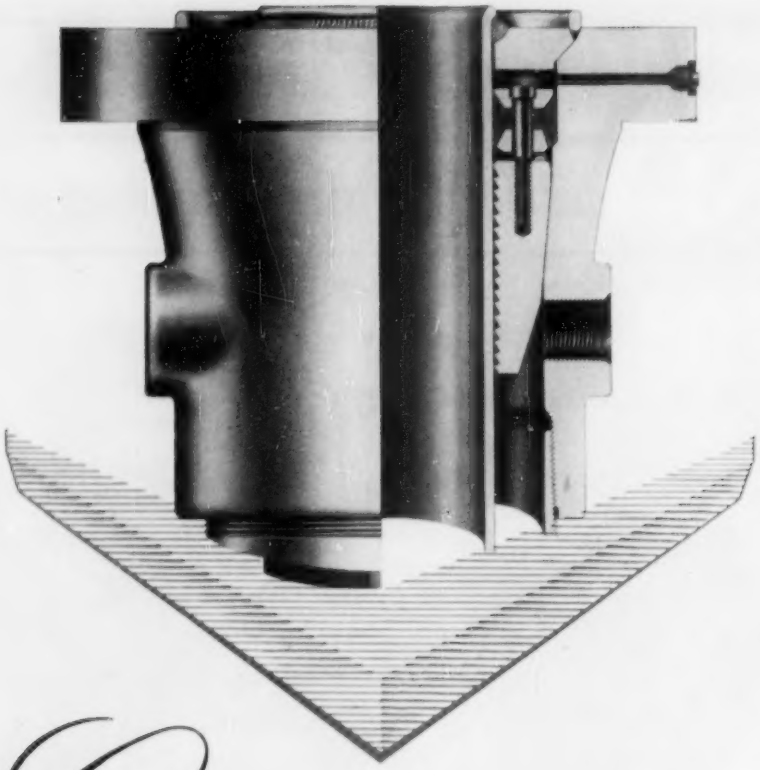

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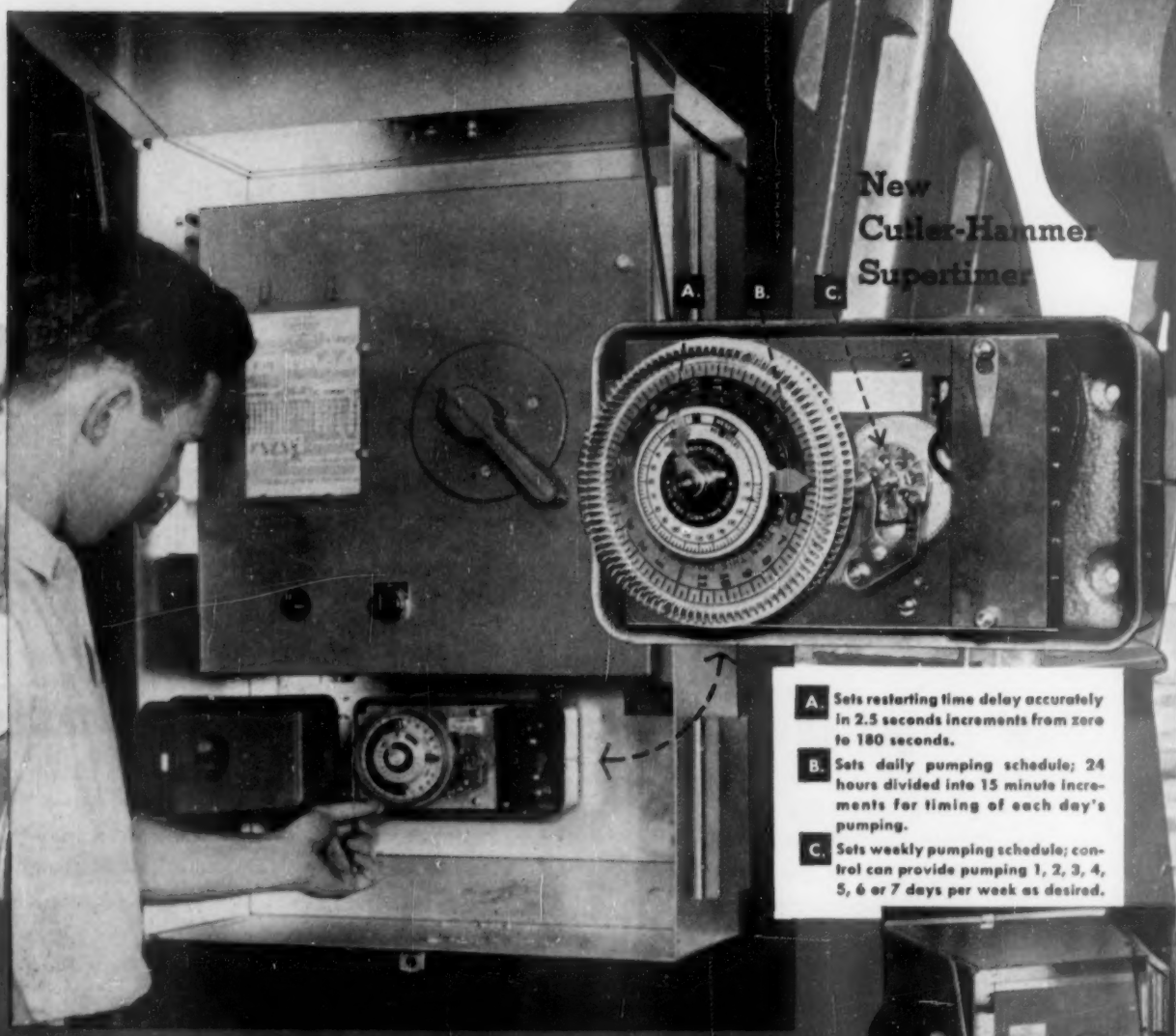
New Cutler-Hammer brings **full automation**



New Cutler-Hammer Supertimer

A. Sets restarting time delay accurately in 2.5 seconds increments from zero to 180 seconds.

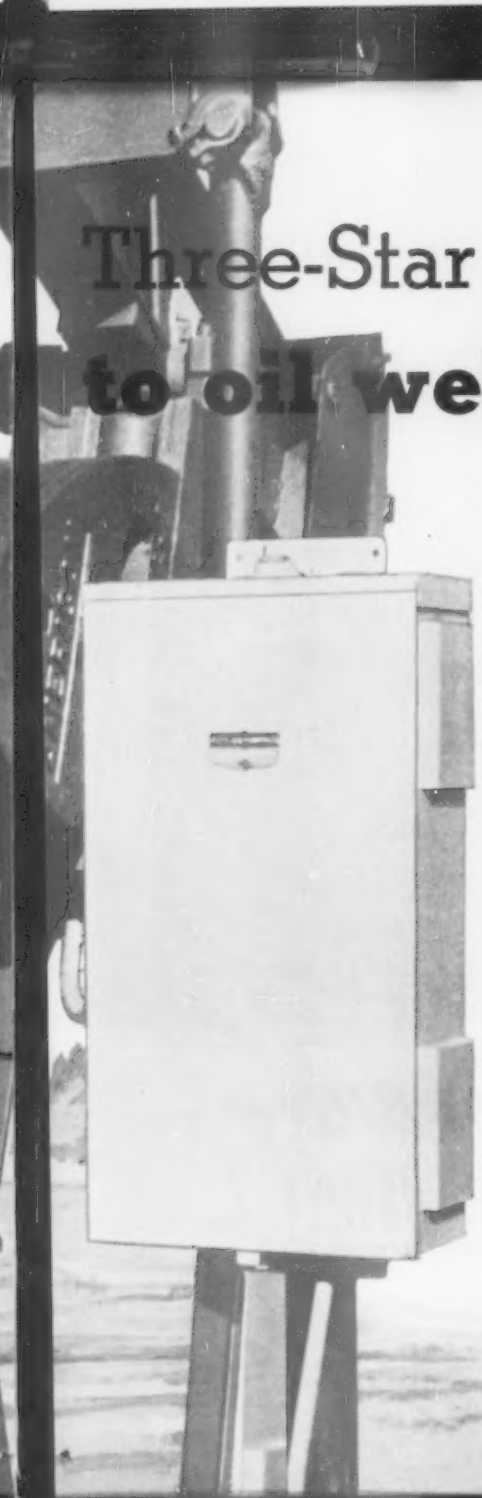
B. Sets daily pumping schedule; 24 hours divided into 15 minute increments for timing of each day's pumping.

C. Sets weekly pumping schedule; control can provide pumping 1, 2, 3, 4, 5, 6 or 7 days per week as desired.

Nothing left to chance

The new Cutler-Hammer Supertimer not only controls the pumping schedule, it offers a selection of 73 restarting time delays in 2.5 seconds intervals from zero seconds to three minutes. This allows definitely timed sequence restarting of any number of pumps after any power interruption, avoids undesirable coincidental restarts.

Three-Star Motor Control
to oil well pumping



If automation means completely automatic operation, oil well pumping has it today. With a remarkable new Cutler-Hammer Three-Star Motor Control unit, oil wells can now be pumped on a pre-set schedule to meet any field allowable . . . completely unattended *indefinitely* as far as the programming or the electrical equipment is concerned. When a power outage occurs, any number of pumps restart in a fixed sequence to prevent overloading the power lines. The control is protected against lightning and the motors are protected against single-phasing which often results from lightning. Designed for cool operation even in the most blistering heat . . . bugs, sand, rain, or ice cannot enter the enclosure.

The heart of this new control is the Cutler-Hammer Supertimer. It does two things. First, it provides the means for setting the desired pumping schedule (hours per day and days per week). Second, it provides 73 accurately *controlled* restarting intervals (restarting time delays from zero seconds to as much as three minutes) to provide *definite* sequence starting of any number of pumps after any power interruption. Nothing is left to chance; unfortunate coincidental restarting of even two pumps is *impossible*. Other Plus Features include "dead-front" protection for pumpers, selector switch for normal automatic operation or manual control for testing and maintenance, new advanced-designed lightning arresters for positive control protection, full three-phase—three-coil overload protection for complete motor overload protection. This control has *everything*, particularly the engineered dependability so vital in any automation.

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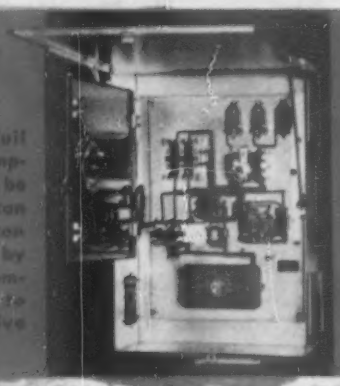
Nothing left to chance

This new control provides full "dead-front" protection for pumpers. The disconnect switch can be thrown, the overload relays can be reset, the Supertimer dials can be adjusted, and test operation by manual control can all be accomplished without exposure to any live parts . . . an exclusive Cutler-Hammer feature.

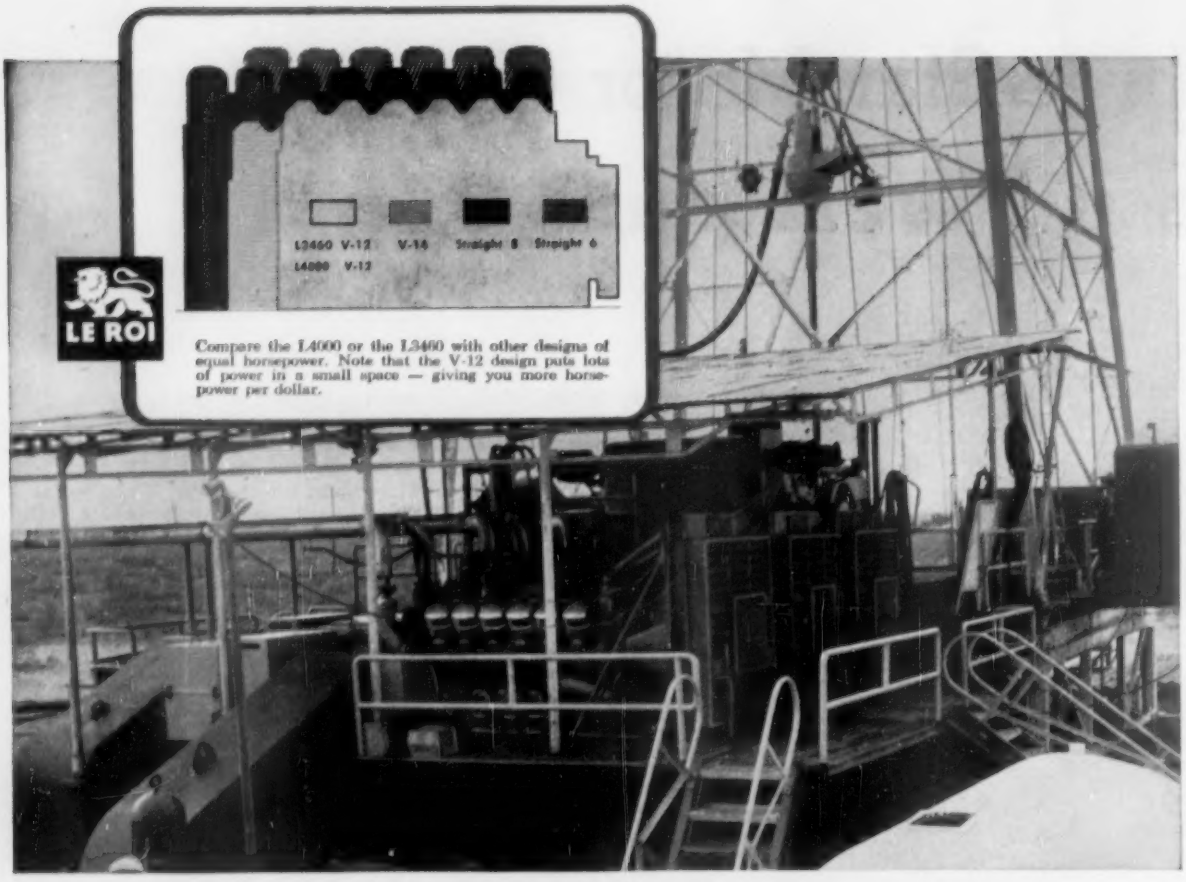


Nothing left to chance

This new control provides dead-phase protection. Protection from circuit unbalance, which can also produce destructive motor heating, is obtained by the use of three overload relays in this "nothing left to chance" control.

Nothing left to chance

Entirely new advanced-design power-line type lightning arresters in this new control not only provide more positive protection; they are arranged so it is impossible for anyone to inadvertently connect a lead for some special purpose in a manner which can destroy the protection afforded by the lightning arresters.



Compare the L4000 or the L3460 with other designs of equal horsepower. Note that the V-12 design puts lots of power in a small space — giving you more horsepower per dollar.

An engine doesn't have to be BIG to be POWERFUL!

The compact, V-12 design of Le Roi's L4000 and L3460 proves it!

Le Roi's L4000 and L3460 engines represent the first truly new design concept in 15 years. They are compact high-output engines, designed with short stroke to give you greater horsepower and speed without compromising engine life.

In addition to the advantages of short-stroke design, these modern V-12's have lightweight pistons, short-radius rotating parts — hydraulic tappets — crankshaft vibration dampener — sensitive controls. That's why they give you hair-trigger response to load demands.

The fuel economy of these engines is good, too. Thanks to advanced-design manifolding, low friction bearings, and low power loss to accessories, they give you rock-bottom fuel consumption.

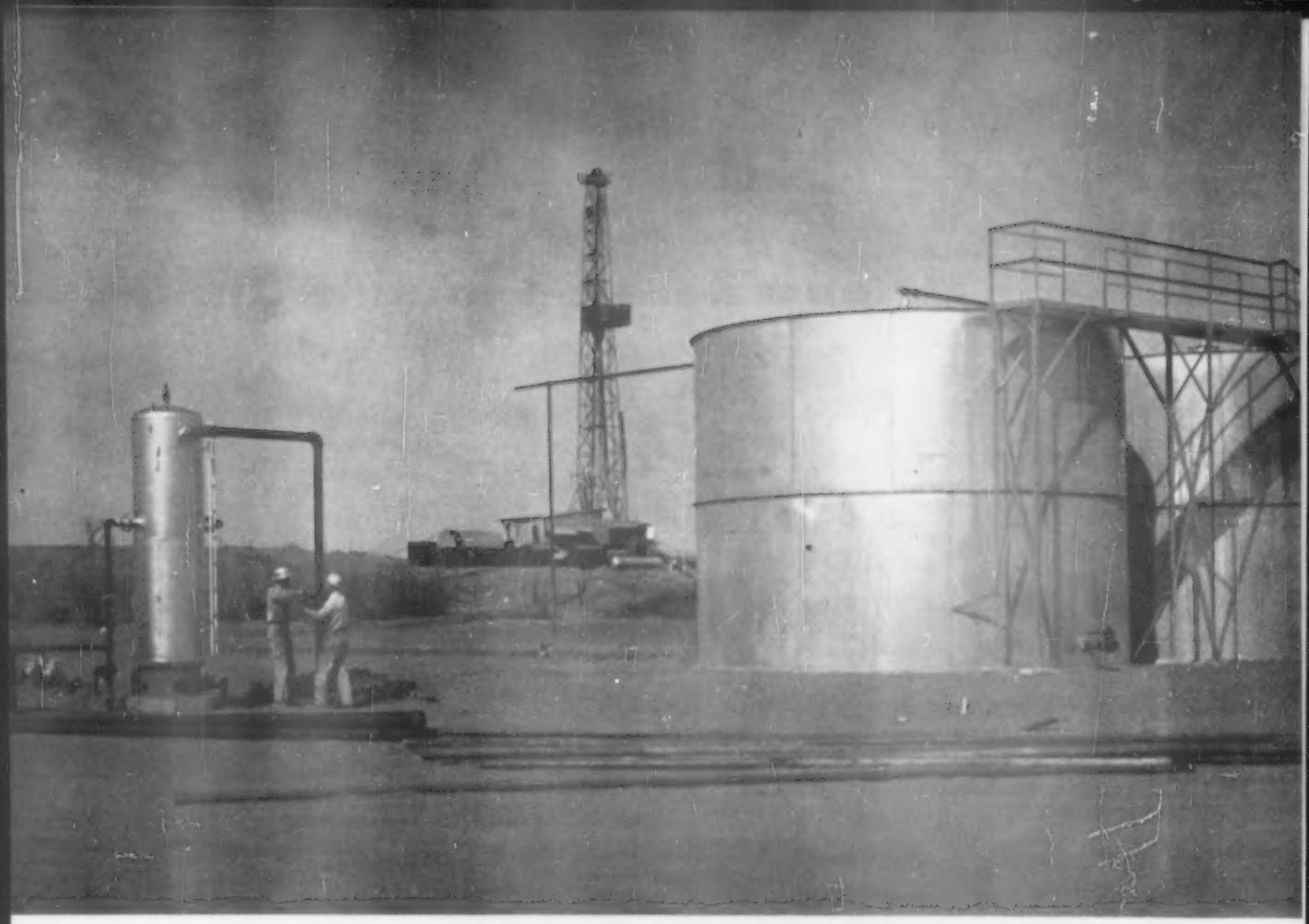
Yes, big surprises come in small packages. That's especially true of the L4000 and L3460. These engines are conservatively rated to give you plenty of power in reserve. The L4000, for example, provides 655 max. hp. and the L3460, 600 max hp. And they have a wide speed range, too, up to 1350 rpm. That's why these engines are ideally suited to a great many oilfield applications: drilling, pipeline station, generator, gas booster, etc.

Engines may come bigger than these Le Roi's, but they sure don't come better! See for yourself — ask your supply house or Le Roi distributor to show you an L4000 or L3460 at work. Call him soon. Bulletins are also available — just write for them.

LE ROI *Division of Westinghouse Air Brake Co.*

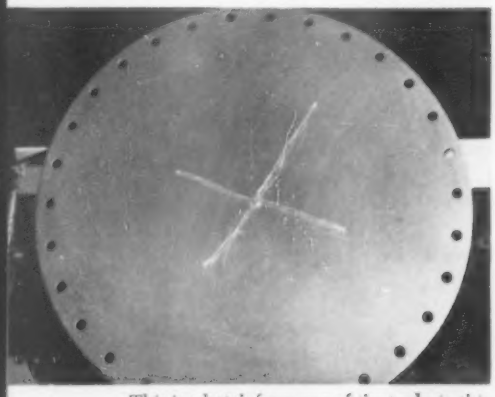
Milwaukee 1, Wisconsin

PORTABLE AIR COMPRESSORS · TRACTAIR · STATIONARY AIR COMPRESSORS · AIR TOOLS · ENGINES



Coating "still like new" after

8 years of sour crude oil service!



This is a hatch from one of the tanks in this test. The coating was 100% intact, the cross being deliberately cut to show the clean, perfect condition of the steel underneath. Data courtesy of **Plastic Coating Corporation,** Houston, Texas.

Protection of these oil tanks for sour crude service is a tough job. Corrosive conditions are always present. Yet, where coatings based on BAKELITE Brand Vinyl Resins are used, they are in excellent condition where others failed in 18 months to 2 years. No other type of protective coatings matched this record of 8 years.

Wherever you find severe service conditions, requiring resistance to moisture, corrosive atmospheres, acids, alkalies—whether applied to metal, masonry or other materials—rely on formulators of coatings based on BAKELITE Brand Resins. For names of suppliers, and a free copy of our booklet "BAKELITE Resin Coatings for Industry," write Dept. PK-128

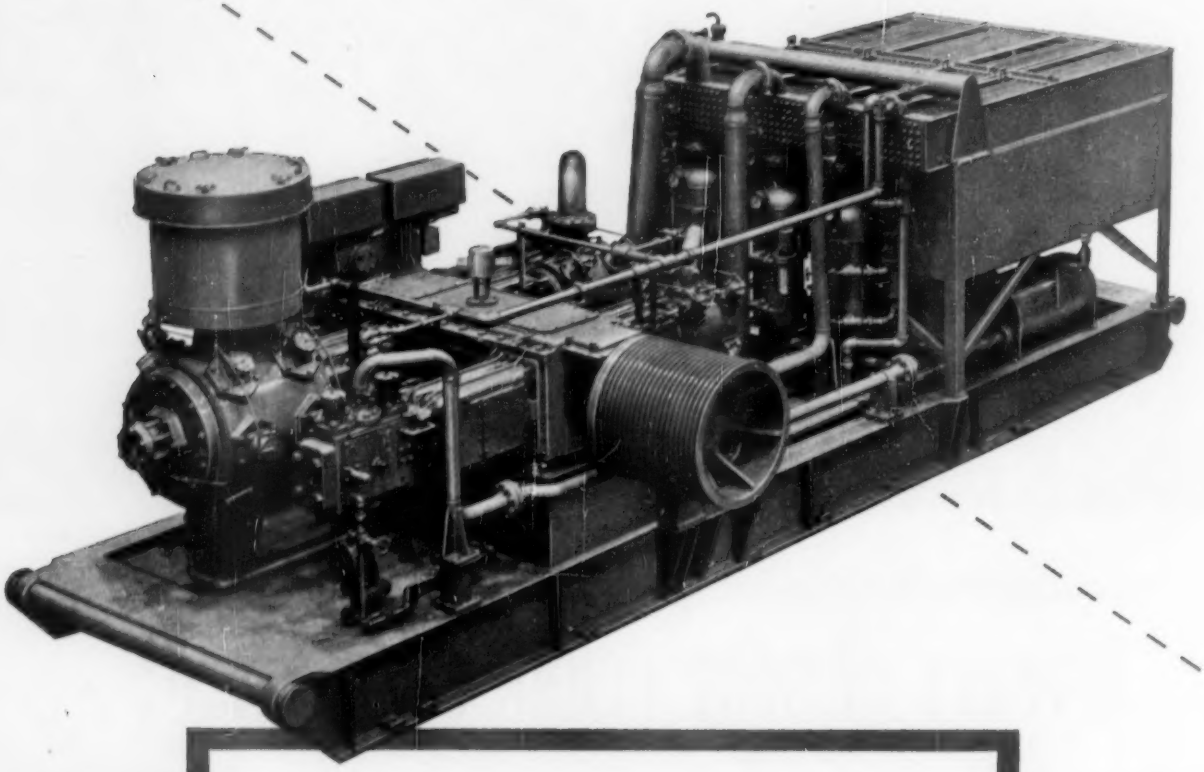
Vinyl, Phenolic, Epoxy, and Styrene Resins for Coatings

BAKELITE
BRAND
RESINS for COATINGS

BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York **17, N.Y.**

The term BAKELITE and the Trefoil Symbol are registered trade-marks of UCC

NEW for air and aerated mud drilling



features

so-well balanced – it operates anywhere

so-rugged – it will give years of continuous service

so-narrow and low – it will fit on any road – it's "Highway Width"

so-automatic – it operates unattended

so-economical – your rig furnishes the power

so-easy on engines – load applied or removed gradually – no engine racing or stalling

so-easy to move – it's medium truck size and one trip moves it

so-dependable – a little preventative maintenance keeps it on the job indefinitely

so-well proved – automotive plants have operated similar compressors for years at a time without a shutdown

THE CLARK *Air Pac*

PACKAGED AIR COMPRESSOR

A rugged packaged compressor for heavy-duty field service

The new Clark Air-Pac is a completely automatic, 500 horsepower compressor station specifically designed for Air and Aerated Mud Drilling.

With the Clark Air-Pac, the operator is assured of an air supply that is completely dependable and as rugged as the rest of his rig. Work stoppage, which often occurs when light, multiple units are used, is eliminated. The Air-Pac is economical to operate too. In most applications there is ample power available from the rig to drive it. It's also easy on manpower. Being automatic, it operates unattended! And when you move to a new site, it's one unit to move—not a dozen.

The Balanced/Opposed vibration free design of the compressor means you can set the Air-Pac on timbers and forget it.

The Air-Pac uses a special, belt-driven, four stage Clark CMA-4 Balanced/Opposed compressor. The compressor, together with a heavy-duty vertical air flow radiator for intercooling between stages and lube oil cooling, is mounted on a rigid steel skid. Discharge pressure can be set and maintained at any level between 500 and 1,500 psi. Pneumatic controllers regulate both capacity and horsepower *input*—automatically.

If you are contemplating air or gas drilling in any form, your nearest Clark representative will be pleased to supply you with added facts on the new Clark Air-Pac or write Olean.

Clark Bros. Co , OLEAN, N. Y.
One of the Dresser Industries
Offices in principal cities throughout the world

CLARK®

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Compressors

Announcing

TWO GREAT EVENTS FOR MAY 17TH

THE CONSOLIDATION OF THREE GREAT COMPANIES

W-K-M Manufacturing Company, Inc., ACF Valve Division and the Key Company — all members of the ACF Industrial Family — have been brought together as W-K-M Manufacturing Company, a subsidiary of ACF Industries, Inc.

Management, Manufacturing and Marketing facilities of all three are now centralized in this new 12-acre completely air-conditioned office and plant at Missouri City, Texas, a few miles west of Houston.

This consolidation provides important efficiencies of production of W-K-M Through-Conduit Valves, ACF Lubricated Plug Valves, Key Return Bends, and Key-Kast Welding Fittings. These products, with a long established reputation for excellent service and performance, will continue to be engineered, manufactured and sold by the same experienced personnel who were instrumental in building that reputation.

OPENING OF A GREAT NEW PLANT THURSDAY, MAY 17TH TWO to SEVEN P. M.

You are cordially invited to inspect our new Plant and Office at Missouri City, Texas, just a few miles west of Houston.

Special transportation from downtown Houston to the plant will be provided for visitors. Please write immediately for your Transportation Pass. Address W-K-M Manufacturing Company, Guest Committee, P. O. Box 2117, Houston, Texas.

W-K-M MANUFACTURING COMPANY, INC.

A SUBSIDIARY OF ACF INDUSTRIES INCORPORATED

PLANT: MISSOURI CITY, TEXAS MAILING ADDRESS: P. O. BOX 2117, HOUSTON, TEXAS

MANUFACTURING

W-K-M THROUGH-CONDUIT GATE VALVES

ACF LUBRICATED PLUG VALVES

KEY RETURN BENDS AND FITTINGS

Here's Why More and More Drillers are Switching to REYNOLDS ALUMINUM OIL COUNTRY PIPE

You can lay and connect 15,000 ft. in three hours

You save up to 90% on installation costs

Every day two miles or more of new Reynolds Aluminum Oil Country Pipe starts to work saving money. That's a lot of pipe. And the demand is booming.

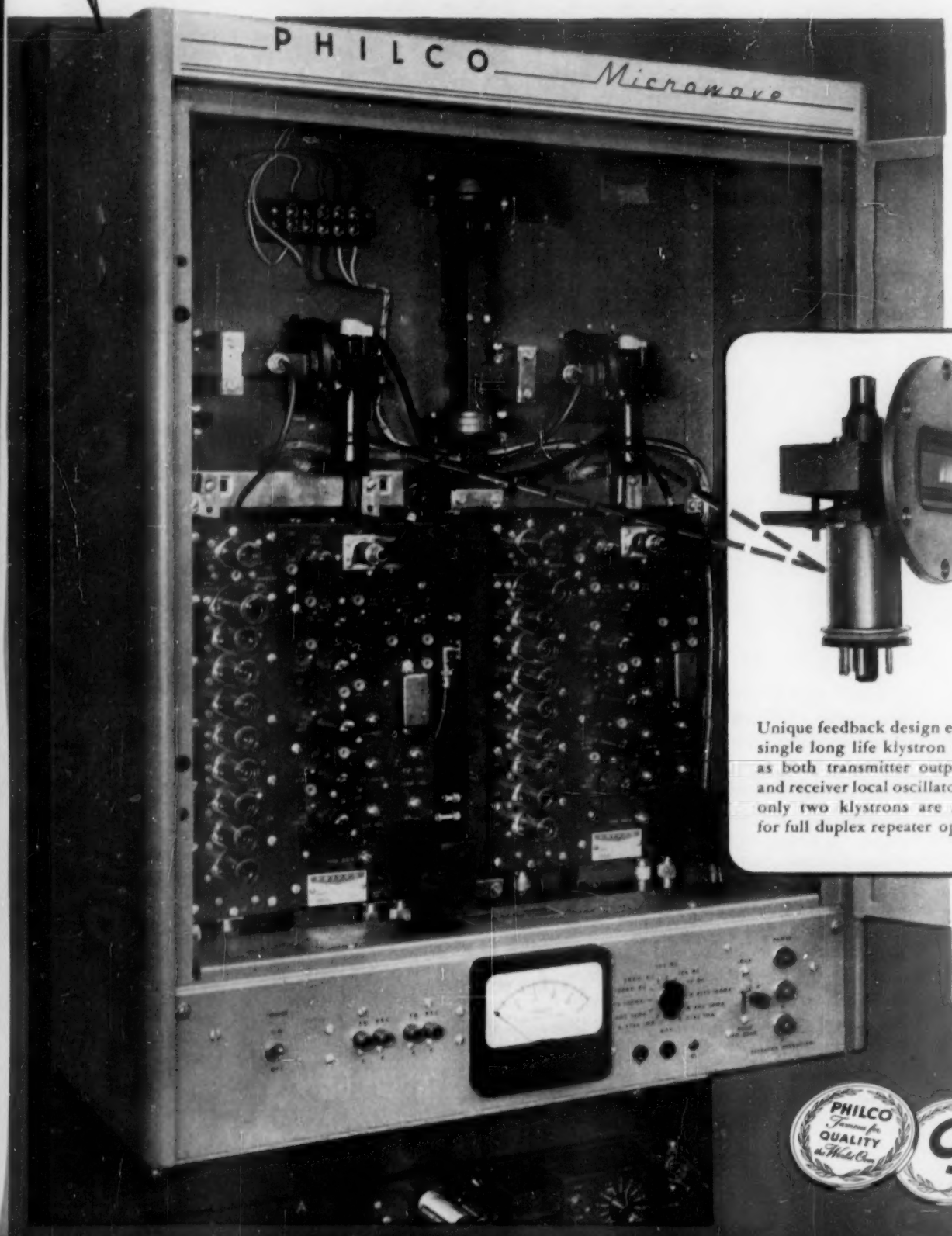
Why the big switch to aluminum? Aluminum is strong, lightweight, rustproof. Every day more drillers find that aluminum pipe streamlines their drilling operation. One truck can carry three miles of pipe. One man can easily carry the 30-foot sections. One man can quickly join the pipe sections in the field. So one crew can lay three miles of pipe in three hours! *No wonder installation costs are cut up to 90%!*

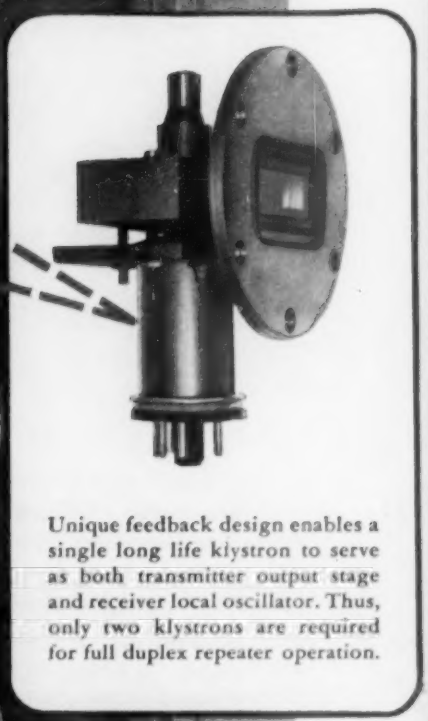
But that's not all! Drillers can now get Reynolds Aluminum Oil Country Pipe *when* they need it . . . *where* they need it. These high-grade, money-saving pipe systems are stocked by leading suppliers throughout the oil country. Call one of their nearby warehouses for immediate delivery on your next job. *Reynolds Metals Company, P. O. Box 1800-CR, Louisville 1, Kentucky.*

The Finest Products Made with Aluminum are made with REYNOLDS ALUMINUM

See "FRONTIER", Reynolds exciting dramatic series, Sundays, NBC-TV

PHILCO gives you





Unique feedback design enables a single long life klystron to serve as both transmitter output stage and receiver local oscillator. Thus, only two klystrons are required for full duplex repeater operation.

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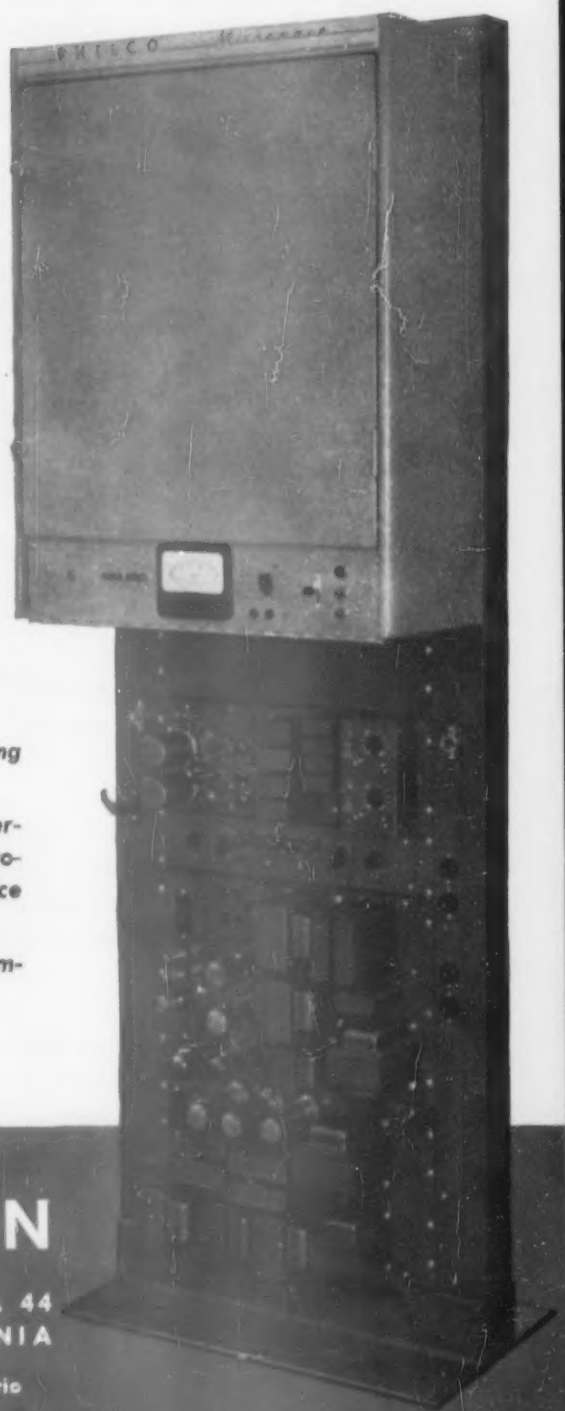
Ten Times More Microwave Power!

PHILCO'S "POWER HOUSE" klystron generates a full watt of power (10,000 watts Effective Radiated Power) in the preferred 6000-8000 mc band . . . provides up to 10db additional safety margin.

Designed specifically for reliable, long distance communications, Philco CLR-7 microwave systems provide high quality communications facilities that accommodate voice, telemetering, supervisory control, teletype, and other forms of data transmission so vital to operations.

Available as a terminal or repeater in Common Carrier, Industrial, and Government bands, Philco CLR-7 microwave provides a degree of reliability never before attained in microwave equipments.

Get complete information on Philco microwave systems. Philco maintains a staff of design, systems, and field engineers experienced and fully qualified to help plan and design your microwave communications system. Write Philco, Dept. OG today.



- ★ ***Designed for continuous unattended operation***
- ★ ***Base band available for telemetering and supervisory control . . . teletype***
- ★ ***Centralized system control from terminal stations***
- ★ ***Built in test and metering facilities***
- ★ ***Portable transistorized termination unit provides two-way signalling on service channel***
- ★ ***Conservatively rated components throughout***

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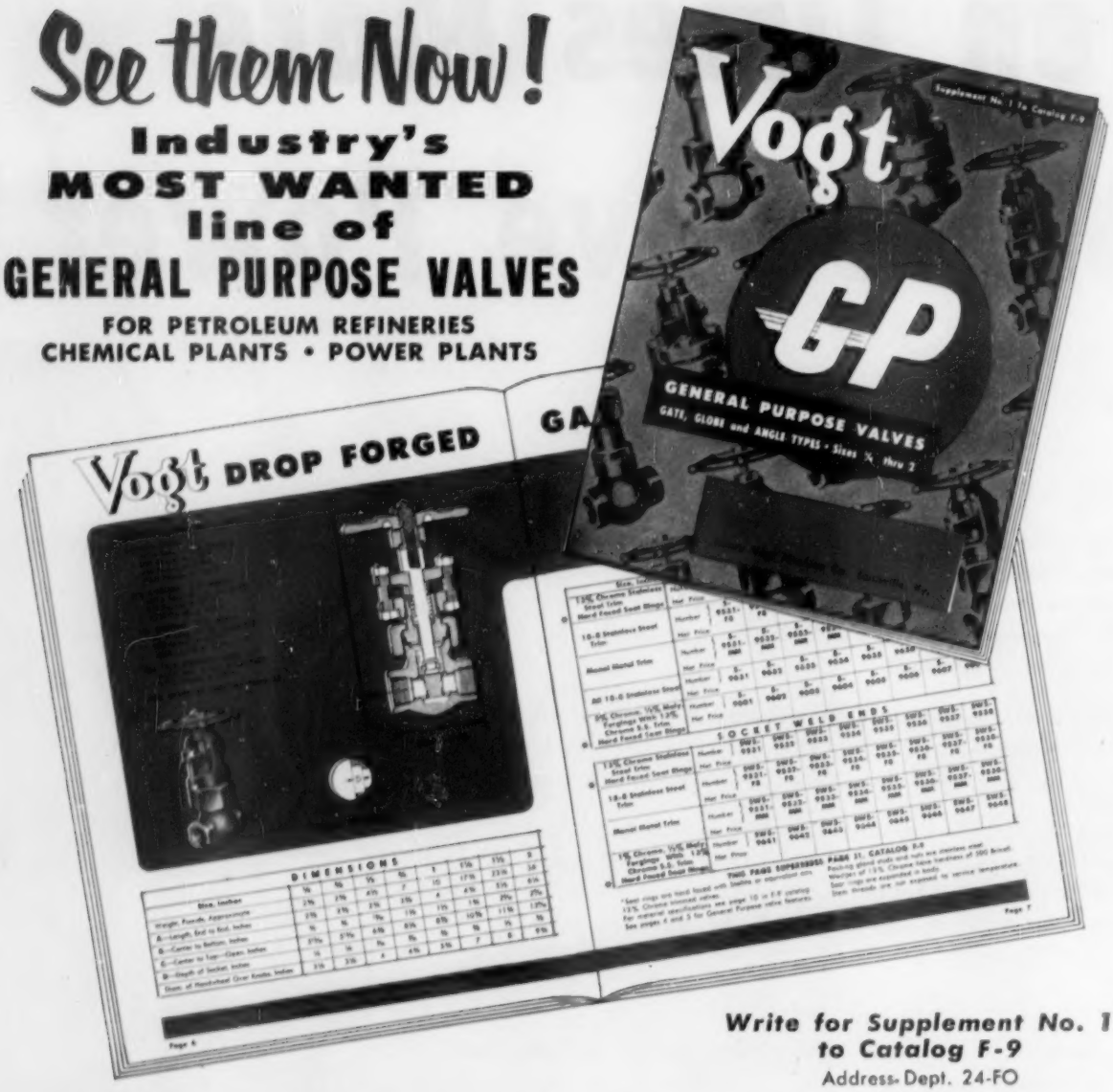
FOR PETROLEUM REFINERIES
CHEMICAL PLANTS • POWER PLANTS



Write for Supplement No. 1 to Catalog F-9
Address: Dept. 24-FO

MOST WANTED — that's right — because the G P line includes gate, globe, and angle type valves having seats faced with **HAYNES STELLITE*** alloy or other hard facing alloys for greater seat-wear resistance . . . at no extra cost!

Hard faced seats, in combination with precision finished, selectively hardened discs and wedges give these valves amazing resistance to erosion, corrosion and galling. That's why they are setting new standards of performance in steam, water, oil, or gas services at the recommended pressures and temperatures.

Get longer, drop-tight, service life with minimum maintenance by specifying Vogt G P Valves. Available in a complete range of sizes from ¼" to 2" and rated 800 pounds at 850°F. and 2000 pounds at 100°F.

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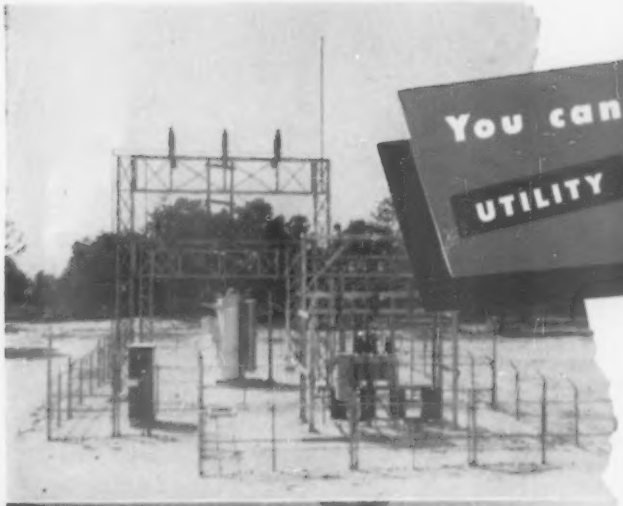
SALES OFFICES: New York, Chicago, Cleveland, Dallas, Philadelphia, St. Louis, Charleston, W. Va., Cincinnati, San Francisco

Vogt — GENERAL GP PURPOSE — Vogt FOR BETTER VALVES

DROP FORGED STEEL

VALVES

*Trade-Mark of Union Carbide and Carbon Corporation



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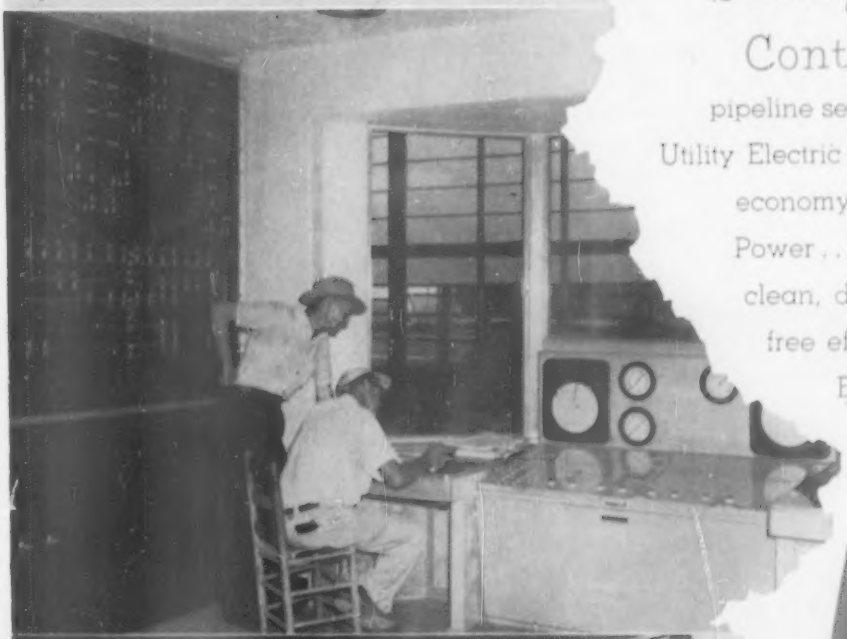
Modern. Low-Cost. Automatic. Labor Saving. Pushbutton Control That's what this pipeline service company gets from Utility Electric Power. The rock bottom economy of using Utility Electric Power . . . plus the advantages of clean, dependable, and trouble-free efficiency . . . makes Utility Electric Power your BEST BUY for meeting any power requirement.



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Petroleum Electric Power Association

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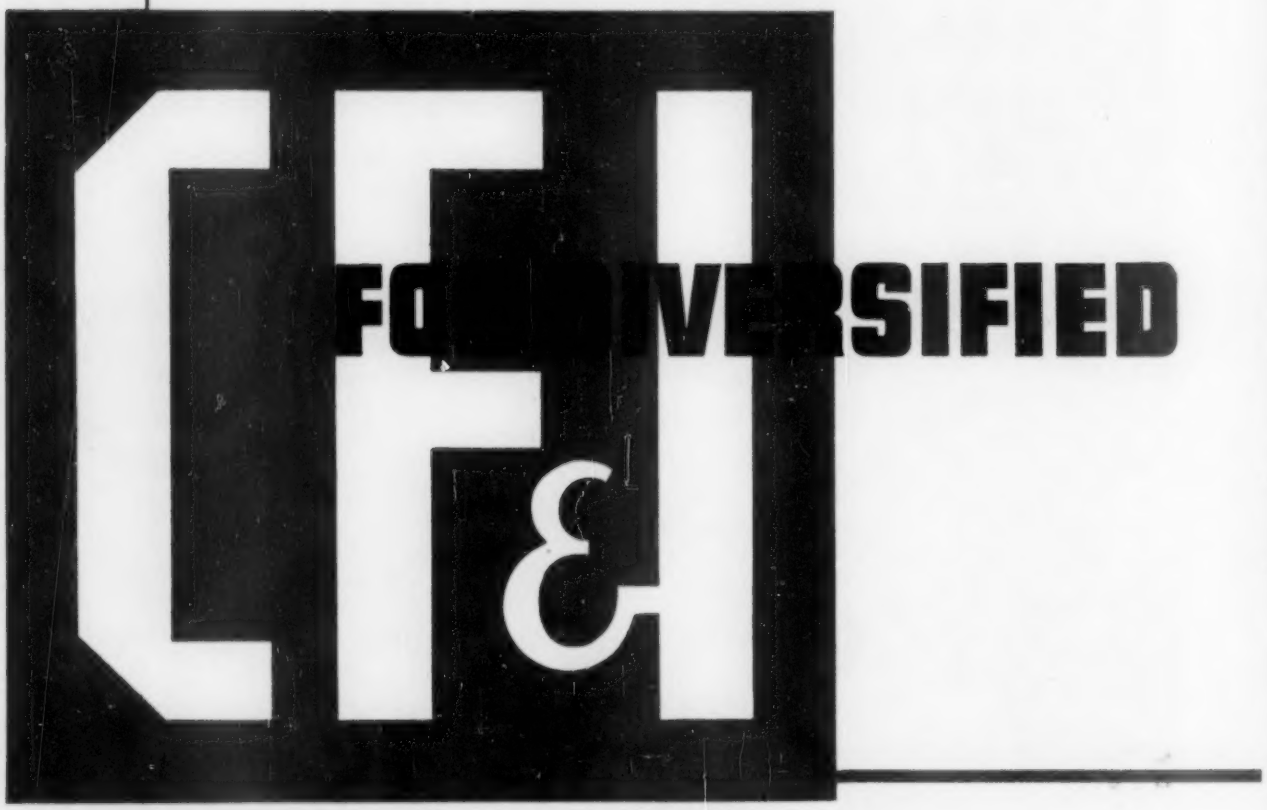
CF&I is one of America's most diversified producers of steel products. For today's CF&I organization was formed from many steel companies, companies which specialized in serving certain industries and certain areas. Because most of these companies had set the quality standards in their own fields for years, many of their brand names have been retained for your convenience.

This is as it should be. These brand names *still* guarantee you satisfaction and quality. You have the added assurance that comes from knowing that these products are made under CF&I's exacting quality control—from ore to finished product.

In addition, you benefit from CF&I's efficient, nation-wide organization which gives you ever-available sales engineering services as well as prompt delivery. Next time you're in the market for steel or steel products, it'll pay you to contact CF&I.



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The quality of CF&I steel products is firmly controlled since the requirements of each product determine the analysis of the steel.

CF&I Buffalo, New York

Fine and Specialty Wire of all types including Manufacturer's Wire (Basic, Spheroidized, Annealed, Tempered, Bright and Liquor Finish, Low and High Carbon)—Welded Wire Fabric—Chain Link Fence—Galvanized Strand.

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CF&I Mt. Wolf, Pennsylvania

Insect Wire Screening and Industrial Wire Cloth.

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CF&I Palmer, Mass.

Wire Rope—Wire Rope Slings—Wire, all types (see Buffalo Plant)—Wire Clothesline—TV Guy Wire—Aircraft Control Cable.

CF&I Pueblo, Colo.

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High Carbon Steel Wire (Hard Drawn, Spheroidized and Tempered)—Rope Wire—Tire Bead—Hose Wire—ACSR Core Wire—High Carbon Spring Steel Wire (All grades, tempers and finishes)—Regulator, Sash Balance and Flapper Valve Wire.

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Blast Furnaces and Open Hearths producing pig iron, ingots, blooms, billets and rods.

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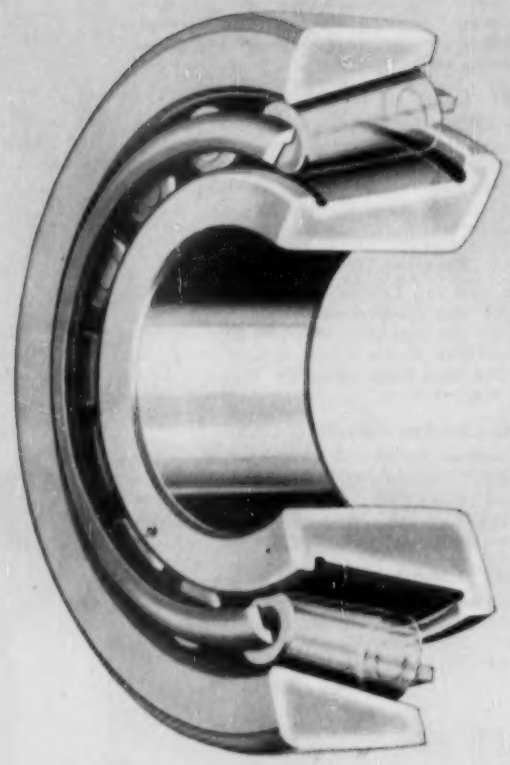
3491

There's a BOWER TAPERED ROLLER BEARING engineered to fit your product



Types and sizes to fit a wide range of tapered bearing applications

There's no need to compromise with bearings! Whatever your product, if it uses tapered roller bearings, call in a Bower engineer for expert help on selecting the exact type and size you need.

Depending on your own particular needs, he'll make sure you get the exact size and type—selected from Bower's complete tapered line—engineered to assure maximum performance in your application.

Most important of all, when you specify Bower tapered roller bearings for your product, you get all the advantages of advanced Spher-O-Honed design—less maintenance, longer life, smoother operation. Get the full facts on the *complete* Bower line.

Tapered, Straight and Journal Roller Bearings for every field of transportation and industry

BOWER ROLLER BEARINGS

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What is your Control Need?

. . . a starter for a fractional hp motor?

This small inexpensive control provides thermal overload protection. . . . Compact construction permits mounting where space is at a premium. Designed for use on ac single-phase power systems . . . up to 230 volts.

. . . a controller for a 2300 to 5000-volt motor?

Here is a control for motors up to 2500 horsepower. All components — contactors, meters, overload relays, auxiliary switches — are selected to meet the particular requirements of your application. Current-limiting fuses give split cycle short circuit protection.

. . . or other applications?

Specific applications, including those between the above-mentioned limits, are made from an extensive line of starters and control components. These standard units are factory assembled in infinite combinations to meet practically any requirement. For help on a particular application, call your Allis-Chalmers representative. His recommendations are backed by Allis-Chalmers engineering departments . . . by experience gained solving thousands of control problems . . . by complete research and testing facilities.

A-4721

A-C ALLIS-CHALMERS

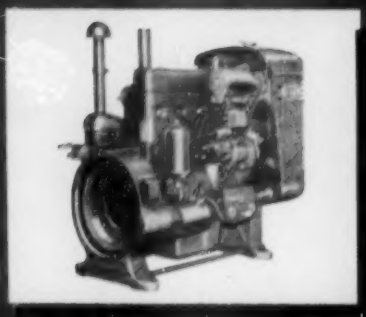
ALLIS-CHALMERS

Milwaukee 1, Wisconsin

To get the advantages that only 54 years of engine

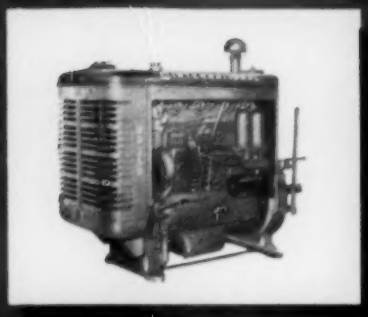
standardize on International®

Here are 3 typical members of the International family of 18



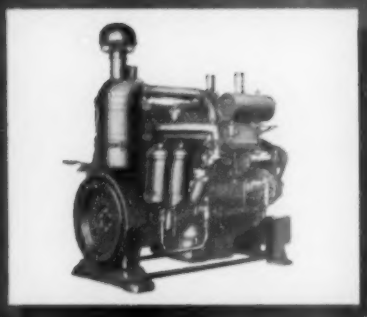
U-169

U-169, rugged 4-cylinder 48.6 hp valve-in-head carbureted unit, delivers top performance on "regular" gasoline. Can be adapted to burn LPG, natural gas, kerosene, or distillate. Ideal for compactors, ⅛-yd excavators, water well drills, fork lifts, rotary snow plows, 12 to 15 kw generators.



UD-350

UD-350, 4-cylinder diesel develops 78.5 bhp as an engine, 75 bhp as a power unit shown above. Available in air compressors, bucket loaders, asphalt mixers and driers, ½-yd shovels and cranes, portable screening plants, 25 to 40 kw generators, hoists, graders, pumps, and trenchers.



UD-525

UD-525, 6-cylinder, 121 bhp diesel with all-weather push-button starting as standard equipment. Available with 14 major attachments, including 43-gal fuel tank, muffler, skid-type subbase. Fits 29 different excavators, graders, compressors, other construction tools.

International power units in various modifications are engineered to team with all these machines:

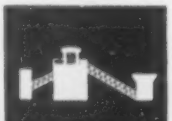
Shovels, Cranes, Draglines
17 Manufacturers

Motor Graders
5 Manufacturers

Air Compressors
5 Manufacturers

Road Rollers
4 Manufacturers

Asphalt Mixers and Pavers
6 Manufacturers



Crushers
5 Manufacturers

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3 Manufacturers

Generators
5 Manufacturers

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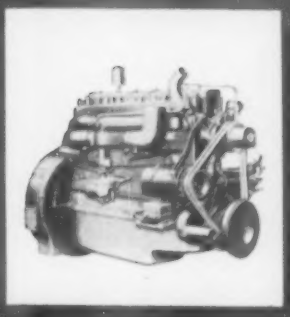
3 Manufacturers

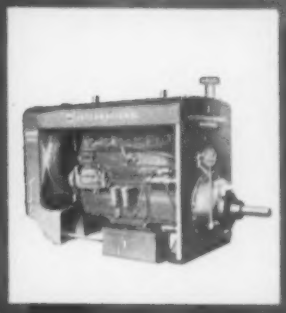
Pumps
12 Manufacturers

leadership can give . . .

Engines



U-450



UD-1091

U-450, one of the most popular 6-cylinder carbureted engines on the market today for trucks, water well drills, 35 to 50 kw generators, graders, ¾-yd shovels and draglines, big rotary snow plows, ditchers and trenchers. Develops 118.5 belt horsepower.

UD-1091, diesel, largest of the 18 International engines, develops 214 bhp, provides exceptional fuel economy for 34 different makes of construction units, including 2 to 2½-yd shovels, 8-cylinder compressors, large asphalt plants and 75 to 100 kw generators.

Engine Model	Displacement (Cubic Inches)	Horsepower (with full equipment less fan)
CARBURETED ENGINES		
U-1	60	17 @ 2500
U-123	123	31.2 @ 2000
U-169	169	48.6 @ 2000
U-264	264	53.5 @ 1600
U-220	220	64 @ 2400
U-240	240	66.5 @ 2400
U-282	282	79 @ 2400
U-372	372	96.5 @ 2200
U-406	406	104 @ 2200
U-450	450	118.5 @ 2200
U-1091	1091	214 @ 1600

Engine Model	Displacement (Cubic Inches)	Horsepower (with full equipment less fan)
DIESEL ENGINES		
UD-264	264	57.5 @ 1800
UD-350	350	78.5 @ 1800
UD-14A	461	100 @ 1800
UD-525	525	121 @ 1800
UD-140-D	525	141 @ 2300
UD-18A	691	131.5 @ 1600
UD-1091	1091	214 @ 1500

In most fields, you'll probably agree, you get the most for your money from the company that's been a leader *for the longest time.*

In engines and power units, the outfit to turn to for longest leadership is International. Since starting manufacture in 1902, International has built and sold *millions of engines* for heavy-duty work! In these 54 years, International has pioneered in developing and perfecting many of the features you consider essential today. Valve-in-head design . . . all-weather diesel starting . . . replaceable cylinder sleeves . . . tocco hardening . . . lubrication through drilled passages . . . precision type bearings . . . full-flow oil filters, to name a few.

These cost-cutting features are backed up with such added advantages as:

Honest horsepower ratings at speeds you can use.

Easy installation with attachments to fit whatever jobs you have.

Fully-experienced sales engineers to help you select and install the engine which best does your work.

Unmatched adaptability, with the same basic engine available as regular or optional power with various modifications in many kinds of equipment (one typical International engine, for instance, fits an International crawler tractor *and 46 makes* of loaders, compressors, asphalt mixers, pavers, excavators, generators, pumps, graders, and rollers). When you power with International, this ready adaptability lessens your parts inventory . . . simplifies and speeds operator training . . . makes your servicing problems a lot easier!

International engine owners get another tremendous benefit, too. To help them is one of the most experienced heavy-duty engine parts and service organizations in the world. At your service are 11 giant regional *parts depots,* 173 Industrial Power *Distributor* locations, *and* hundreds of Power Unit *Dealers.*

To get all these big profit-making advantages, be sure to specify International power. See your nearest Distributor or Dealer for all the facts.

INTERNATIONAL HARVESTER

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A COMPLETE POWER PACKAGE INCLUDING: Crawler, Wheel, and Pipe-Boom Tractors . . . Self-Propelled Scrapers and Bottom-Dumps . . . Tractor and Rubber-Tired Loaders . . . Diesel and Carbureted Engines

Texas oil companies prove the value of split channel radio operation

G-E narrow band equipment serves Loffland Brothers, Standard of Texas, and Seaboard Oil Company

In the Texas oil fields they'll tell you that *practical* split channel radio operation is proving its worth right now. Two major oil companies and a major drilling contractor, operating in an area pointing north from Odessa to Vealmoor and Snyder, have cooperated in establishing three independently operated systems in a range that formerly served two firms.

Rather than share a channel when Loffland installed radio in the area covered by Standard's 48.74 MC frequency and Seaboard's 48.78 MC allocation, the three firms decided to work on an experimental split channel basis. Slight modification of G-E equipment in use narrowed the spacing from 40 KC to 20 KC, permitting Loffland Brothers' new General Electric radios to go on the air on 48.76 MC.

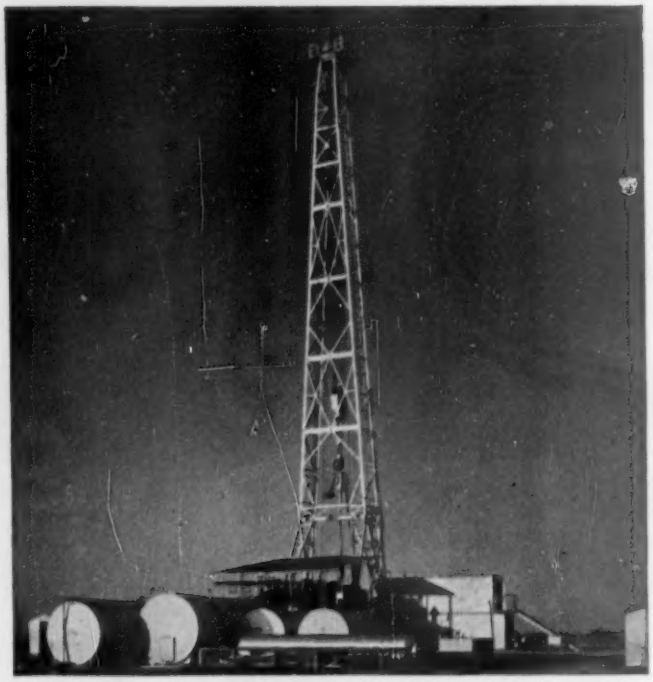
Clear channels for all

Now, each firm operates on its own frequency, without interference from either of the others. Because of split channel operation and General Electric narrow-band radio equipment, three companies benefit from 2-way radio communications without interference to one another.

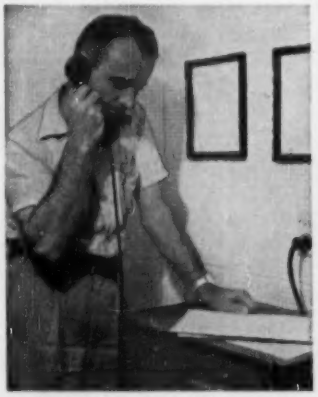
The new G-E Progress Line of 2-way radio equipment provides a complete interchangeable package. Transmitter, receiver, power supply, and optional chassis are individually rack-mounted. Plug-in design permits quick changes of frequency, power, or type of reception.

2-WAY MOBILE RADIO

Your General Electric Communications Counselor will be pleased to cooperate with you in planning a split channel operation for your company. Call him in, or write today to: *Section X856-7, General Electric Company, Communication Equipment, Electronics Park, Syracuse, New York.*



RADIO ANTENNA CAPS LOFFLAND BROTHERS' RIG near Odessa, Texas. Nine General Electric base stations and mobile radio units have cut $400 per month from former telephone costs.



STANDARD OIL OF TEXAS operates two G-E 60-watt base stations linking seven mobile units with the main base at Snyder, Texas. Radio speeds orders, makes instant decisions possible for fast action.

SEABOARD OIL COMPANY maintains instant operational contact with field locations through 5 G-E base stations. 20 mobile units coordinate widespread drill site activities in the West Texas area.

Progress Is Our Most Important Product

GENERAL ELECTRIC

How to Put the Spurs to a Traveling Block

SpringKore

J&L SpringKore has sparked more interest than any other wire rope in the history of rotary drilling.

The core is a tightly coiled tough steel spring. It bends with less fatigue. It resists crushing, yet cushions the strands around it.

SpringKore starts you off right. You string up more readily because your line is more flexible. Your block falls straight, true, fast.

Under load, you have the feeling that everything is just right. You know that lubricant stored in the center of the core is fighting rust and wear. Around the drum and over the sheaves there is minimum distortion, instant recovery.

It's a great line — SpringKore. Let's talk about it; get your J&L store on the telephone!

Jones & Laughlin

SUPPLY DIVISION – Tulsa

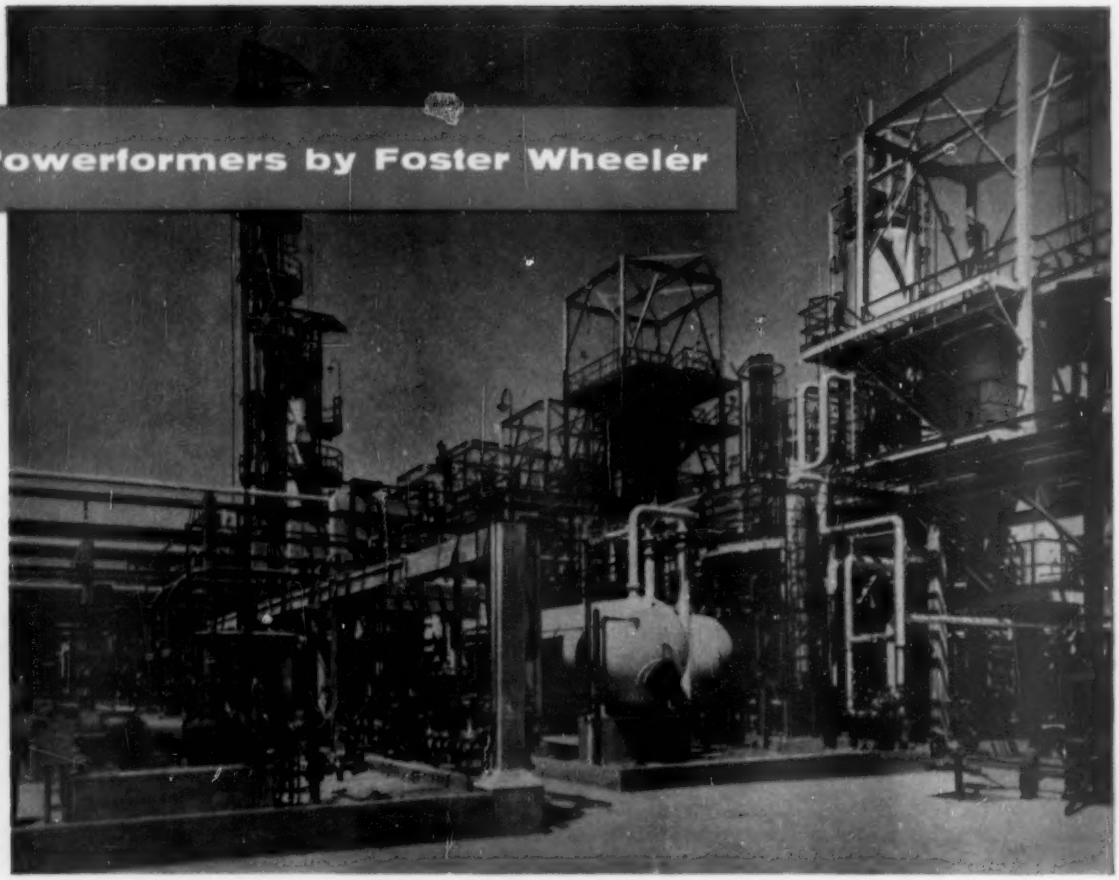
SERVING THE UNITED STATES AND CANADA

J&L wire rope drills the world's deepest wells. The pride and interest of your J&L store follows a rotary line through every ton mile of dependable service.

9-5

power

86.3



This Powerforming unit, designed and constructed by Foster Wheeler for Esso's Baltimore refinery, charges approximately 3,000 barrels per day of heavy virgin naphtha which has been desulfurized in a Hydrofining unit whose operation is integrated with that of the Powerformer.

FOSTER

NEW YORK • LONDON

forming

percent, 98* clear

*Research Octane of Debutanized Reformate

- **New, more active platinum catalyst**
- **Special regenerative technique maintains optimum catalyst activity**
- **Lower pressure operation – 200 to 300 psig**
- **Higher yields of high octane reformate**

This combination provides the refiner with a most effective means for the catalytic reforming of low-octane naphthas into high-octane motor fuel components.

Powerforming, developed by Esso Research and Engineering, has already proved its outstanding performance on three units which are now in successful operation. Fourteen more are under construction or in the design and planning stage.

The first Powerforming unit, shown at the left, in operation since May 1955 was designed and constructed by Foster Wheeler for Esso's Baltimore refinery. FW is currently providing mechanical design and construction for two more Powerforming units — a 20,000 barrel per day unit at the Bayway refinery and a 7,000 barrel per day unit at Imperial's Halifax refinery where Foster Wheeler is also building Crude Distillation, Fluid Catalytic Cracking, Polymerization and Treating units. For further information write to *Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.*

WHEELER

PARIS • ST. CATHARINES, ONT.

Let this "Visiting Fireman" train your men to fight fire . . . it could save your business

You have a *potential* fire-fighting team right in your plant. These would-be fire fighters *could save your business if fire struck unexpectedly.* All they need is training, the kind that will enable them to respond instantly and properly to any kind of fire emergency.

Ansul can provide this training for a group of your men just as it has for hundreds of its customers. And there will be no charge. It is just one of the "essential" services that Ansul provides for its customers.

Twenty years experience in the fire protection industry has proved to Ansul many times over that all the fire equipment in the world will not save your business *unless* trained hands are available to man that equipment. So, it is important to Ansul that you get *training* along with the fire equipment you buy. Only then will you experience the security that goes with having a complete fire protection program. Only then will you get what you really pay for, what you really need—*complete fire protection.*

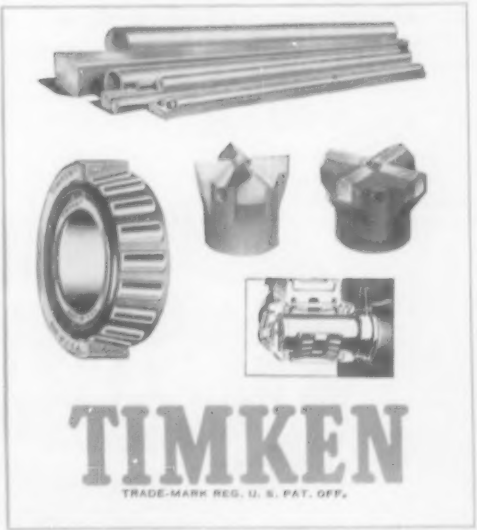
You owe it to the life of your business to learn more about Ansul's in-plant fire training service. Get in touch with your local ANSUL MAN through the yellow pages of your phone directory, he will be happy to call on you and explain all of Ansul's customer services in detail. Or write to THE ANSUL CHEMICAL COMPANY, Dept. OG-5, Marinette, Wisconsin.

ANSUL

You mean what you say, when you say "TIMKEN"

IF you are content with just any old kind of tapered roller bearing, steel or rock bit, of course you don't specify "Timken". By the same token, when you want highest quality you don't specify anything *but* "Timken". To make sure you get what you want—to safeguard your reputation and ours—we stamp "Timken" on every product we make. When you say "Timken" we know you *mean* a product made by the Timken Company . . . because, as everyone is aware, "Timken" is a trade-mark, not *just a type of product.*

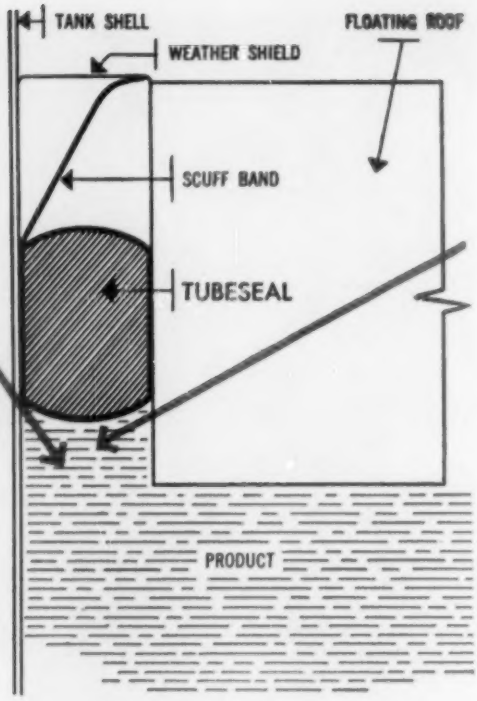
When you purchase tapered roller bearings, alloy steel bars, seamless steel tubing or removable rock bits, always look for this famous legal identification. When you see it, you know there are over 55 years of experience behind it. When you *say* it, you're saying exactly what you mean: "I want the best." The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".



TAPERED ROLLER BEARINGS • REMOVABLE ROCK BITS • FINE ALLOY STEELS

THE SECRET OF A GOOD FLOATING ROOF:

NO ROOM FOR VAPORS*



*NO EVAPORATION
NO FIRES
MINIMUM CORROSION

Because there is no space in a HAMMOND TUBESEAL FLOATING ROOF, where vapor can form, jet fuels and other volatile products can be stored with assurance that evaporation and fires cannot take place and further that corrosion will be kept to a bare minimum.

THE HAMMOND TUBESEAL

The most efficient and positive seal known: no moving parts · no mechanical maintenance · climate proof · non-corrodible · can operate to bottom of tank or above the top · no vapor space below the seal · entire circumference has tight seal under pressure at all times.

LICENSES AVAILABLE

The makers of TUBESEAL believe that its unique safety and economy factors should be allowed to benefit the broadest possible section of the petroleum industry. For that reason HAMMOND IRON WORKS will license its use on a non-exclusive basis. For further information write to:

HAMMOND IRON WORKS,
Warren, Pa.

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HAMMOND TUBESEAL COSTS NO MORE IN THE FIRST PLACE

* Patent applied for

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IRON WORKS
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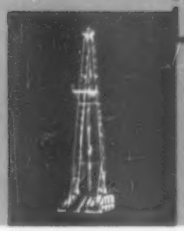

published for the busy oil man by Lane-Wells Co.— one of the Dresser Industries

Plugging Problem Studied

New perforating techniques to avoid trouble may result from extensive tests conducted by Humble's researchers

FORT WORTH. – New ideas on how to make jet and bullet perforating more successful have been turned up by Humble Oil & Refining Co.

The ideas resulted from a comprehensive study just completed by Humble in cooperation with perforating-firms. The results were reported at the A.P.I. Production Division's southwestern district meeting here by T. O. Allen and H. C. Worzel of Humble's Houston offices.

Tests, according to the Humble men, revealed there are important factors to consider other than depth and area of shot hole. They took into account pressure differences between formation and well bore and type of fluid in the bore as well as design of gun and charge.

Plugging . . . Most significant finding appears to be that considerable plugging of perforations results from use of both jet and bullet guns.

Also this plugging can be reduced by using the right gun and proper perforating techniques. Plugging was found in some instances to stem from gun or charge design and in others from downhole condition during the operation.

Generally, Humble found these two rules to hold true:

. . . Don't perforate with drilling mud in the hole. The perforations often are plugged with mud, sand, and charge debris. Use of a clean fluid such as oil or salt water where possible helps prevent this.

. . . Don't perforate with differential pressure from the well bore into the formation. This helps carry mud, charge debris, and sand into the perforation. Back-flowing often cannot clean out the plug.

The company also found that many jet perforators plug the perforation with "carrots" or plugs which are part of the charge liner. They are carried into the shot hole by the jet stream.

Wedge-shaped liners do not appear to produce carrots that survive the detonation but cone-shaped linings with apex angles of 60° or less do.

Humble thinks that this fault of cone-charge design can be corrected if the liner is asymmetric. Then the carrot and the jet stream travel in slightly different directions.

Those charges exposed to well fluid apparently do not produce carrot plugging since detonation pressure is expended in all directions. Those charges in aluminum or closed-steel carriers proved to be the worst offenders.

When differential pressure is from formation to well bore, considerably fewer carrots are found in perforations. Other Humble findings:

. . . Both jet and bullet guns cause compaction of sand around a perforation. If this is held in place by mud, sand, or charge debris, it causes a reduction in well productivity.

. . . Penetration with bullet guns drops as the strength of the casing and formation rock increases.

. . . Better cleanout and flow rate result with smooth perforations 7/16 to 1/2-in. in diameter and 6 or 7 in. deep rather than with much deeper but rougher holes with smaller diameter.

Wrong sign . . . Perforation plugging is a serious problem because it can cause erroneous small estimates of productivity in wildcat wells or new zones in field wells.

Plugging can also cause:

. . . Premature flooding of completion intervals with salt water or gas, thus forcing abandonment of recoverable reserves.

. . . Aggravated sanding problems, in unconsolidated sands, by causing excessive pressure drawdown around perforations remaining open.

. . . Irregular drainage of various members of laminar sands like those producing oil on the Gulf Coast.

Check 5-1 on the attached card for the full story.

Reprinted from Oil and Gas Journal, April 2, 1956

NEW #7 POWDER CHARGE EXTENDS BULLET REACH

Betters Payoff Chance

In an oil zone, the difference between success and failure may ride on the head of a perforator bullet. An inch of penetration, more or less, may spell the difference between commercial production and abandonment. Thus the development of the new Lane-Wells #7 powder comes as mighty important news to oil men. This because the 24% greater penetrability of this new propellant means an even

WANT MORE INFORMATION?

More information on items here will be sent to you gladly on request. A code number appears at the end of each article. For additional information about that item circle that code number on the reply card at the bottom of page 3. Just mail the card — we'll pay the postage.

greater proportionate chance of job success.

In the first place, the resulting deeper penetration gives correspondingly greater drainage area. Twenty-five 15/32" shots fired through casing and cement into a hard formation by the Lane-Wells #3 powder (still rated a powerful propellant, by the way) might result in a total drainage area of about 110 square inches.

The same number of bullets fired from the same guns using #7 powder would yield a total drainage area of 140 square inches. The thirty extra square inches alone will mean more barrels of oil per day, quicker payoff, and more return on the original investment.

But that is not all. As production men know, filtrate from drilling mud will substantially reduce the oil permeability of any zone that it penetrates. This water blocking effect decreases radially from the well shaft. Thus, bullets given 24 per cent greater penetration because of the #7 powder may help to realize much greater than 25 per cent increase in production, because they will have reached a zone of increased oil permeability. Just how Lane-Wells engineers were able to design a powder which would give greater propelling force without decreasing safety factors, makes quite a story in itself. Told simply, and in exquisitely non-technical language, the #7 powder doesn't just go off with a bang, with a short high peak of maximum explosive effort. It gives a sort of prolonged push. In terms of the refining gentry, it would have a high-octane, high anti-knock rating.

If you check G-2 on the attached card, Lane-Wells will be happy to send you more information about this remarkable powder.

LANE-WELLS OFFERS TWO KONESHOT GUNS FOR THRU-TUBING WORK

Once an interesting possibility, thru-tubing perforating now has advanced to the stage where operators can exercise considerable choice about the equipment employed. The question no longer is: Can the job be done? Now it is: Which equipment can do the job best?

Lane-Wells offers two different types of small-diameter Koneshot perforators for thru-tubing operations. Each one, though slimmed down in bulk to permit easy passage through lubricator and tubing, will do a man's size job of perforating. Each gun is adjustable for length, and one has adjustable shot spacing. While the perforators themselves have been scaled down, the safety operational program is king size; in other words, it's the standard Lane-Wells five-point safety system.

Here are the specs on the Lane-Wells thru-tubing guns. One will do the job best for you.

The J-1 Retrievable Perforator —This gun leaves *nothing in the well to interfere* with production or operational procedure. Available in 1¾" and 2⅛" O.D. sizes. Both use 180° phasing in 4-foot shooting sections. Fires six shots per foot in 1¾" O.D.; four shots per foot in 2⅛" O.D. Fires all shots horizontally. Operates in pressures up to 20,000 psi.

The Swing-Jet Gun – This perforator is available in running-in O.D. sizes of 1⅜" and 1¾", which swing out to a shooting O.D. of 3⅛" and 4⅜" O.D., respectively. The Swing-Jet principle permits great power and deep penetration within the restrictions of thru-tubing operations. Carrier is frangible thin-walled aluminum. Charges cannot be fired in any but the shooting position. Adjustable for length, guns fire four charges per foot at 180° phasing.

Check G-3 on the attached card for all information on these Junior-sized instruments for King-sized performance.

SUPER BRAINBREAKER

Two brothers and two sisters inherited 1000 acres of land in the form of a parallelogram. By the terms of the will each of the two sisters inherited 35% of the total acreage and each of the brothers 15%. Also, under the terms of the will, each allotment had to border on the outer perimeter of the 1000-acre plot and each had to have a common point on the long diagonal of the parallelogram.

Geometrically demonstrate and prove how this opportionment could be made.

Check G-4 on the enclosed card to determine the right answer.

Answer to folded paper problem in last issue: The length of the fold CD is 9.23".

ABSTRACTS — CURRENT AND PERTINENT

GET THAT GRADUATE, AND HOW – The rush is on for graduating engineering personnel. Interviewers and placement personnel speak out on how oil companies and colleges can work together to expedite employment. Check G-5

THROUGH TUBING RECOMPLETION PAYS OFF, OFFSHORE – Transporting and lifting a derrick to recomplete an offshore well would cost big money; so, the operators decided to rework the well through tubing. They succeeded – and at a saving of 84%! Check G-6

A FISH STORY, WITH A MORAL – The moral in this case is that persistence, though expensive, proved cheaper than redrilling from a new location. Check G-7

HITTING A ONE-FOOT TARGET AT FOUR MILES – STRAIGHT DOWN – Finding and perforating the desired interval at 21,670' called for highest order performance on the part of the wireline equipment involved. Temperatures and pressures ran better than 340° F. and 20,000 psi, respectively. Check G-8

PERFORATOR SELECTION MADE EASY – What to expect in the way of jet or bullet perforating is graphically shown. Chart enables operator to choose type of instrument best suited for his job. Check G-9

ANYBODY FOR THE GOOD OLD DAYS?

The snappy rig pictured above delivered nitro to the oil fields about the turn of the century. Safety precautions called for the umbrella to prevent sunstroke. So well did this work that practically none of these blitz wagon drivers ever died of sunstroke.

THRU-TUBING INSTRUMENTS YIELD FULL-SIZED LOGS

If an operator wants to log his well through tubing, he can get just as good a log as one run through casing—with Lane-Wells on the job. For, in Radioactivity logging of permanent type completions, only the instruments have been scaled down; accuracy, sensitivity, and formation delineation remain the same.

In every test, the junior-miss-sized logging instruments have yielded results on a par with those coming from their heftier counterparts. Headaches connected with getting the job done by means of a small diameter instrument, have been ironed out by Lane-Wells engineers—who, no doubt, had a few of their own in the process.

Designed especially for thru-tubing operations, the Series 300 Radioactivity Well Logging equipment utilizes the latest developments in Geiger-Mueller radiation detectors. The downhole Gamma Ray-Neutron instruments themselves are available in 1¾" and 2⅝" O.D. sizes. With both, as with the standard-sized instruments, Lane-Wells offers simultaneously run collar logs. An even smaller 1⅜" Gamma Ray instrument also is offered in certain areas.

To supplement the instruments running in the hole, Lane-Wells utilizes surface control equipment designed and built especially for permanent-type completions. In fact, Lane-Wells is the only company that supplies a completely integrated thru-tubing operation. One phone call will bring a completely operational unit.

Check G-10 on the enclosed card to find out more about it.

NEW DOMESTIC SALES MANAGER

C. L. Kirkman has been named Manager of Domestic Sales for Lane-Wells Company, one of the Dresser Industries. In making the announcement, Jas. D. Hughes, Vice President for Sales and Service, pointed out that Kirkman will have charge of the company's sales activities in the United States.

Kirkman has been Division Sales Manager for Lane-Wells Mid-Continent Division with headquarters in Oklahoma City. A graduate of the University of Oklahoma, he joined Lane-Wells Company in 1937. He has held most of the positions in both operations and sales in the division.

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Complete information about the items appearing in this publication is available without charge to qualified oil company employees and oil well operators. Please fill out the forms completely, giving Company and Title as well as your address and indicate whether or not you want to be placed on the mailing list to receive more information on these subjects as it becomes available.

LANE-WELLS TODAY!

Please send me complete information about the item numbers circled at the left.

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G2 G7
G3 G8
G4 G9
G5 G10

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W P O

These are the 4 big reasons why operators get better service from LANE-WELLS PACKERS

1 **LONGER LIFE**

2 **EASY PULLING**

3 **LEAK-PROOF PACKOFF**

4 **POSITIVE SETTING**

And here are a few of the design and construction features which give these 4 big values:

SLYDEZE dovetailed slips which can't catch or hang up the packer, and don't "freeze" to the cone.

CROSS-CUT wickers which hold firm on hardest casing, without harming the casing.

CONTROLLED-EXPANSION sealing element which springs back to shape upon release, and doesn't "vulcanize" to the casing.

LIFTING LUGS which insure release of the sealing element.

LARGE BY-PASS (in valve-type packers) which gives fast running in fluid.

FULL-DIAMETER mandrel which allows free passage of tools.

There's a LANE-WELLS PACKER "tailor-made" to fit your job— **write for complete information.**

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Tomorrow's Tools - Today! ®

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How to Set Down Only One Pound of a Nine-Ton Load!

Hydrocrane Does It with Precision Hydraulic Control

1 Hydrocrane's control is so fine that load movement can be almost imperceptible to the eye. Here a 9-ton load is lowered to ordinary household scale on table.

Take a good look at this remarkable demonstration of Hydrocrane control, then picture a Hydrocrane at work for you. For setting beams or concrete slabs, pouring cement or setting a plate glass window — *any* job that requires hairline control — nothing can beat the Hydrocrane in saving you time and money.

The all-hydraulic Hydrocrane is an expert at working in close quarters, too. It has the shortest tail swing, size for size, of any revolving crane, and its unique telescoping boom can reach out and poke a load into hard-to-get-at places.

Contractors who own Hydrocranes call them, "the handiest machine we have." You'll say so too when you get all the facts from your Bucyrus-Erie distributor. Do it soon.

SEEING IS BELIEVING!

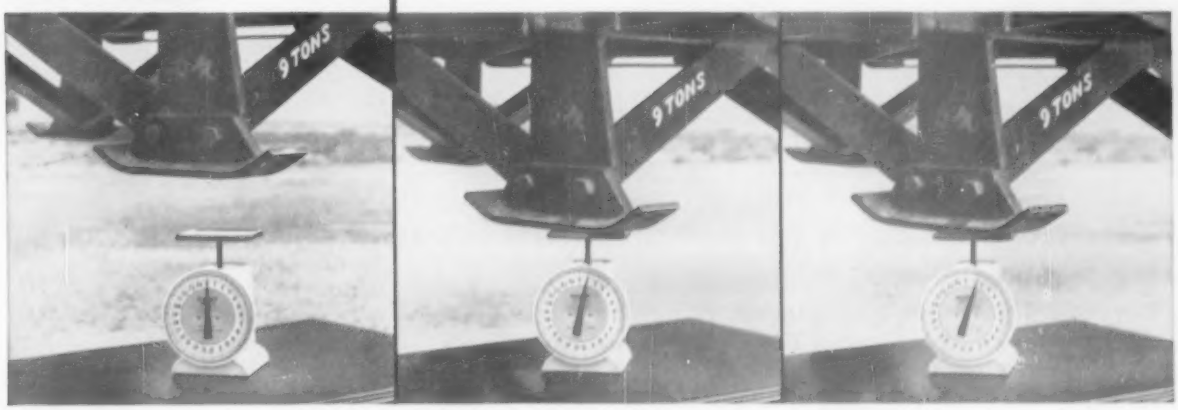
The experiments shown here were made with a standard 9-ton capacity H-5 Hydrocrane at Bucyrus-Erie's test and research grounds near South Milwaukee. The sled and billets, being lifted, totaled 18,363 pounds when weighed on a certified scale. Note that this is *the maximum rated lifting capacity* for this crane — hardly favorable conditions for such a test! 114H56

H-3 HYDROCRANE • 4-ton, ⅜-yard

H-5 HYDROCRANE • 9-ton, ½-yard

BUCYRUS ERIE

South Milwaukee, Wisconsin



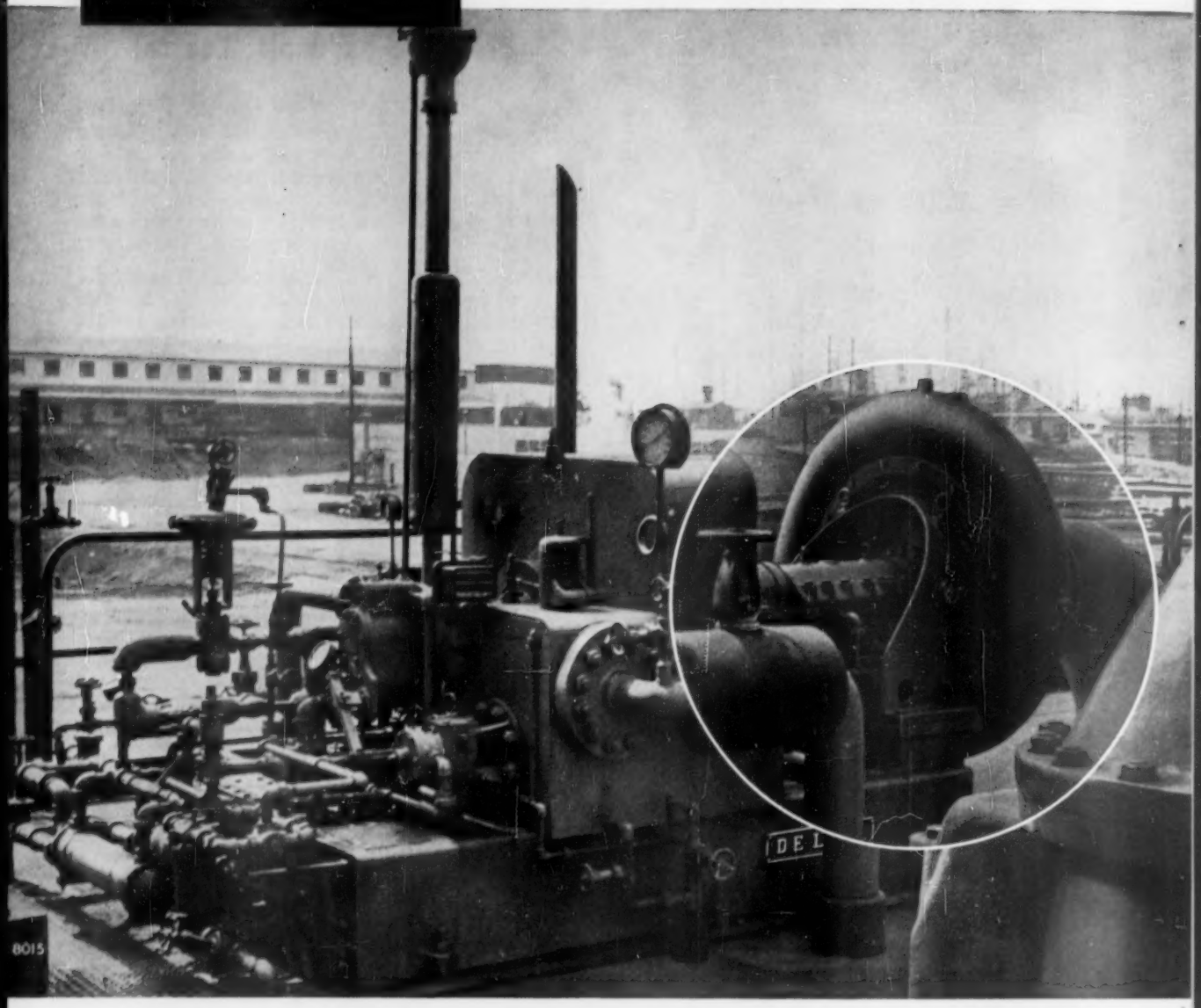
2 Closer and closer it comes. No jerks — just a carefully controlled movement as load nears scale.

3 Contact! And so-o-o easy that scale registers only one pound of that big 9-ton load. That's precision control in action!

4 Now the operator "feathers" his control lever a hair, and look— the scale pointer moves to a pound and a quarter!

DE LAVAL CENTRIFUGAL BLOWER

controls air in cat cracker at Standard Oil of California



This De Laval centrifugal blower, selected by the Fluor Corporation, is on stream at the Standard Oil Company of California's new cat cracker in El Segundo. For control air service, this blower delivers 9,500 cfm; inlet pressure is 15.4 psig and discharge pressure 19.4 psig. The blower is driven by a De Laval 220 brake horsepower MCP Turbine operating at 800 psig with a temperature of 650 F; it has all labyrinth shaft packing for high back pressure service.

In addition to single stage designs, De Laval makes a complete line of equipment for all refinery services, including multi-stage compressors driven by De Laval multi-stage turbines for condensing, non-condensing and automatic extraction applications.

Send for new Bulletin 0504

DE LAVAL *Centrifugal Blowers*

DE LAVAL STEAM TURBINE COMPANY

810 Nottingham Way, Trenton 2, New Jersey

OL 389

DOW

Dow tank trucks provide fast, efficient service on diethylene glycol, triethylene, monoethanolamine, diethanolamine and other chemicals for treating natural gas.

you get

DOW DIETHYLENE GLYCOL WHEN AND WHERE YOU NEED IT

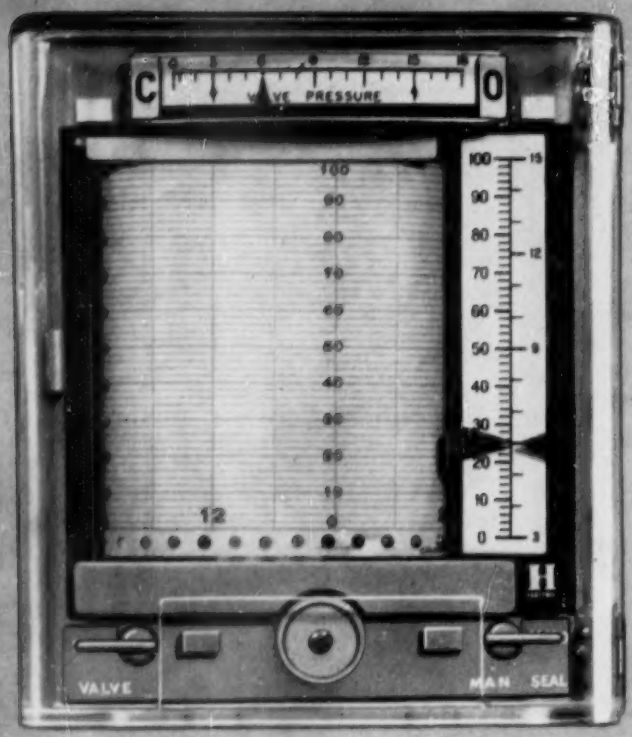
Fast Delivery to Well, Pipeline Substation or Storage Facility from Conveniently Located Dow Terminals

A big part of the gas dehydrating problem is solved by having an adequate supply of the right chemical at the right place whenever you need it. Diethylene glycol and other gas-treating chemicals may be needed anywhere along the line from well to consumer.

The many Dow shipping points are one reason why Dow service on diethylene glycol, triethylene glycol, monoethanolamine and diethanolamine is unexcelled. It permits you to keep your inventory at a minimum, and it assures rapid handling and prompt delivery of your order.

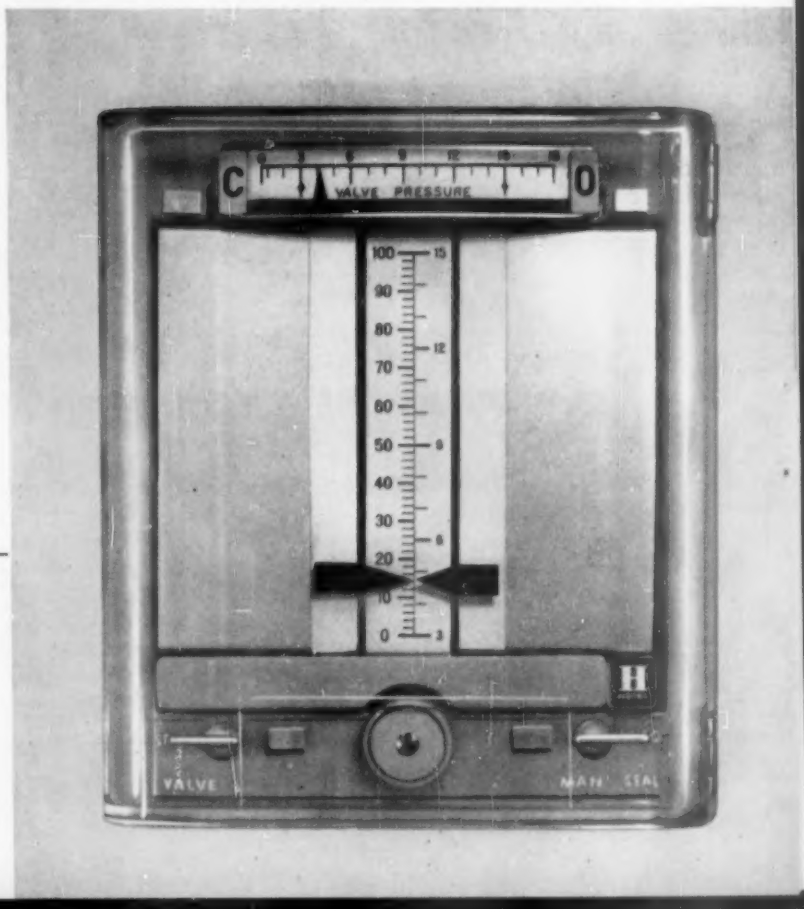
Ask about the many other advantages you get when you buy gas-treating chemicals direct from Dow. Contact your nearest Dow sales office or THE DOW CHEMICAL COMPANY, Midland, Michigan.

you can depend on DOW CHEMICALS DOW



for simplest

Both the *Tel-O-Set* indicator and recorder have vertical indicating scales on which large, opposing pointers clearly show measured value and set point. The control knob and transfer switches are located near the bottom of the case, where they can be manipulated without the operator's hand obscuring the view of the pointer and scale.



● **REFERENCE DATA:**

Write for Bulletin 7202.

Design your instrumentation

installation, startup, service

–with *Tel-O-Set* instruments

The exclusive features designed into *Tel-O-Set* miniature instruments save you time, trouble and money . . . from the instant these instruments are installed on your control panels.

Easy installation. The indicating and recording chassis is a complete assembly that can be supplied separate from the case. Since the case contains the valve pressure gage and pressure regulator, you can install it in the panel, make complete piping connections . . . and then insert the instrument chassis later, at startup.

Foolproof startup. Because it can be shipped separately, the chassis is protected against dirt and damage until it is ready to begin service. Air lines can be checked, control valves stroked and final inspection made *before* the chassis and controller are installed.

Serviced in seconds. Down-time for instrument maintenance is eliminated, for a complete chassis can be replaced in just a few seconds. There is no loss of control during replacement . . . no disturbance to electrical connections. To adjust zero and span, or to inspect parts, you can partly withdraw the chassis from the case, without interrupting operation.

Tel-O-Set instruments can handle a broad range of temperature, pressure, flow and liquid level applications. They work with any type of pneumatic force-balance controller. They are sensitive and accurate . . . have true linear calibration . . . respond instantly to changes in measured variables. For a discussion of how you can use them profitably, call your local Honeywell sales engineer . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

COMING SOON!

Ample supply of

PALCOTAN
MUD CONDITIONING CHEMICAL

To meet growing world-wide demand, expanded chemical production facilities will substantially increase available PALCOTAN supply

Palcotan has come into growing demand not only throughout this country, but also in other lands. Because of its effectiveness and economy, *Palcotan* is shipped regularly even to Latin America, the traditional source of drilling mud additives imported into this country.

A little over a year ago, *Palcotan* production was first doubled, then tripled. But demand was already growing so rapidly that construction was started on a new chemical plant expansion that will provide a tenfold increase in supply. These new facilities will be in production by June of this year. The Pacific Lumber Company is grateful to the many who have cooperated in an allotment program during periods of limited supply, and is happy to announce that *Palcotan* will soon be available in ample quantity.

FOR MORE EFFECTIVE LOW-COST CONTROL OF VISCOSITY, GEL STRENGTH AND WATER LOSS

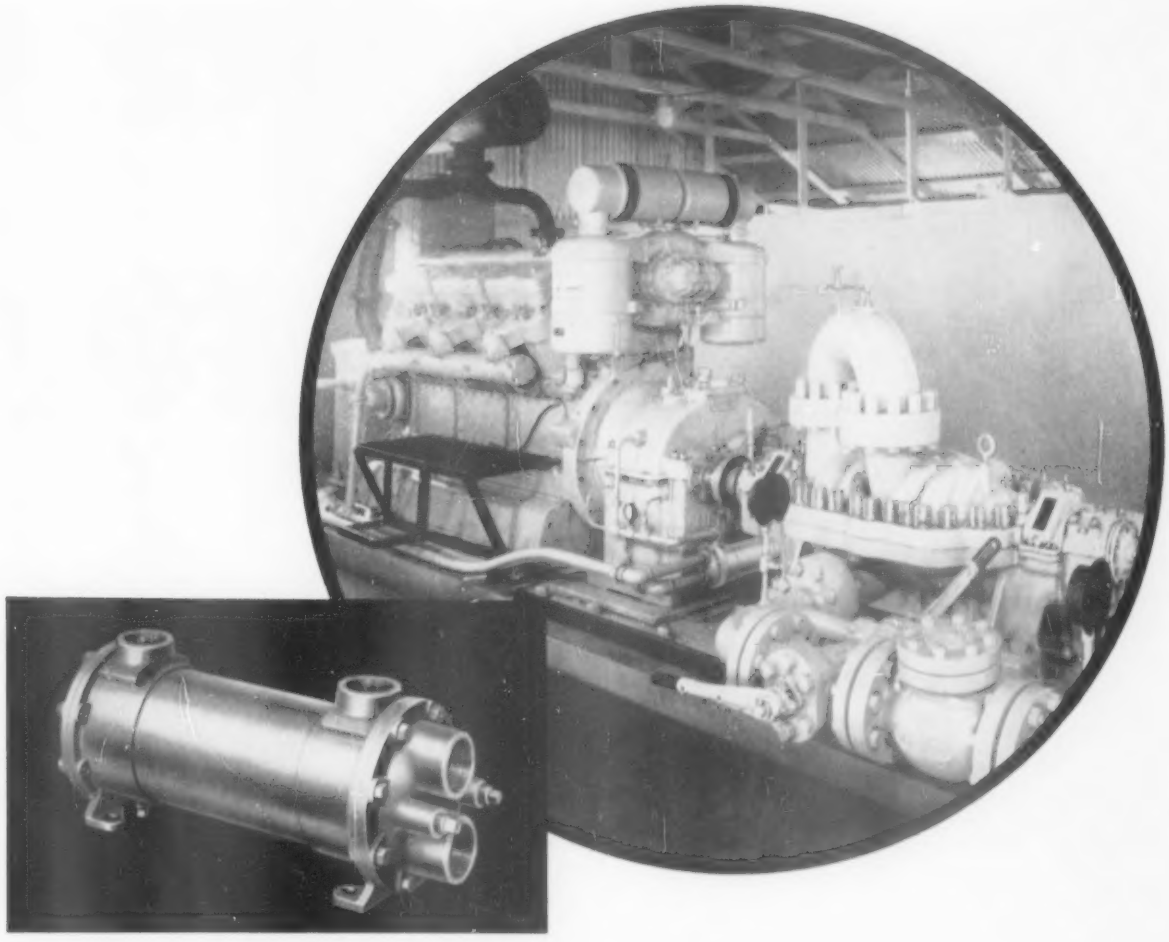
- High efficiency, especially at low concentration
- Readily soluble in cold water • pH-7 • Non-toxic
- Exceeds specifications for quebracho in many applications
- Can be added with or without caustic • Substantially lower in cost than other additives
- A stable compound not affected by atmospheric conditions
- Coarse powder form, conveniently packed in easy to handle 50-lb. multiwal paper bags

WRITE FOR BULLETIN No. 4-01 describing the properties and operating advantages of Palcotan

Available through oil field and mud service organizations

DEVELOPED THROUGH PALCO RESEARCH

THE PACIFIC LUMBER COMPANY
100 Bush Street, San Francisco 4, California



ROSS EXCHANGERS

extend engine and oil life of this "round the clock" Caterpillar Diesel

Driving a centrifugal pump, at a 1000-barrel per hour rate, this Caterpillar Diesel Engine runs 24 hours a day, 30 days a month, the year around at a Texas pipeline pumping station.

To assure continuous, trouble-free lubrication and correct operating temperatures, Caterpillar installed two Ross Exchangers as standard equipment. One delivers an adequate supply of properly cooled lube oil to moving parts of the engine, while the other cools the jacket water . . . lengthening both engine and oil life.

Ross Exchangers are used extensively throughout the pipeline industries because of their high thermal efficiency and extreme ruggedness . . . in fact, in every industry where controlling lube oil, jacket water or hydraulic fluid temperature is necessary for the operating efficiency of machinery.

They are completely pre-engineered and fully standardized in a wide range of sizes.

Bulletin 1.1K5 will give you detailed information. Write. Ross Heat Exchanger Division of American-Standard, 1417 West Avenue, Buffalo 13, New York. In Canada: Kewanee-Ross of Canada Limited, Toronto 5, Ont.

ROSS

EXCHANGERS

Discussion goes on even at the coffee-break at the annual Standard Oil Dealers' Advisory Council meeting in Chicago. Left to right: W. H. Miller, Standard Oil assistant general manager of sales; W. C. Lane, dealer in Kansas City, Missouri; D. F. Benton, Standard Oil vice president, sales; W. H. Harrison, dealer, La Porte, Indiana; A. C. Sailstad, Standard Oil general manager, sales. INSET: August Arnoldi of Denver, Colorado; Wilbert Barnickle of Mendota, Illinois; Harlan G. Lewis of Bellevue, Nebraska—all dealers.

Well-known Newscaster, WJBK-TV, Detroit

Jac LeGoff asks small businessmen:

"HAS A BIG BUSINESS EVER ASKED YOUR ADVICE?"

Denzil Watkins,
Standard Oil Dealer, St. Louis, Missouri:
"This is my third year at this meeting where Standard Oil dealers discuss sales and service problems with company executives for three days. Nine dealers, who are elected by other dealers at regional meetings, give the company advice, which is always very carefully considered. The result is better service and better products!"

Manuel Mislove,
Standard Oil Dealer, Milwaukee, Wisconsin
"One of the smartest things any big business can do is to consult the people who come in contact with customers. That way, it can find out first-hand what the public needs and what its sales people need to keep customers coming back. Standard Oil does just that. The company asks our advice and acts on it. And our customers benefit."

Roy Wilson,
Standard Oil Dealer, Brainerd, Minnesota:
"This was my first opportunity to talk to top executives at Standard Oil about problems that are very important to dealers—products, sales and service. It's a wise company policy to talk over such matters with the men who meet the public. Actually we helped plan the meeting by first outlining the matters we wanted to discuss."

W. H. Ehrenberg,
Standard Oil Dealer, St. Joseph, Mich.:
"Under the dealer advisory plan, I represent many Michigan Standard Oil dealers who elected me to meet with company officials. That's certainly an example of a big company asking for advice from small businessmen. Did you know that Standard Oil's popular plan for guaranteed radiator protection came out of a dealer-company meeting?"

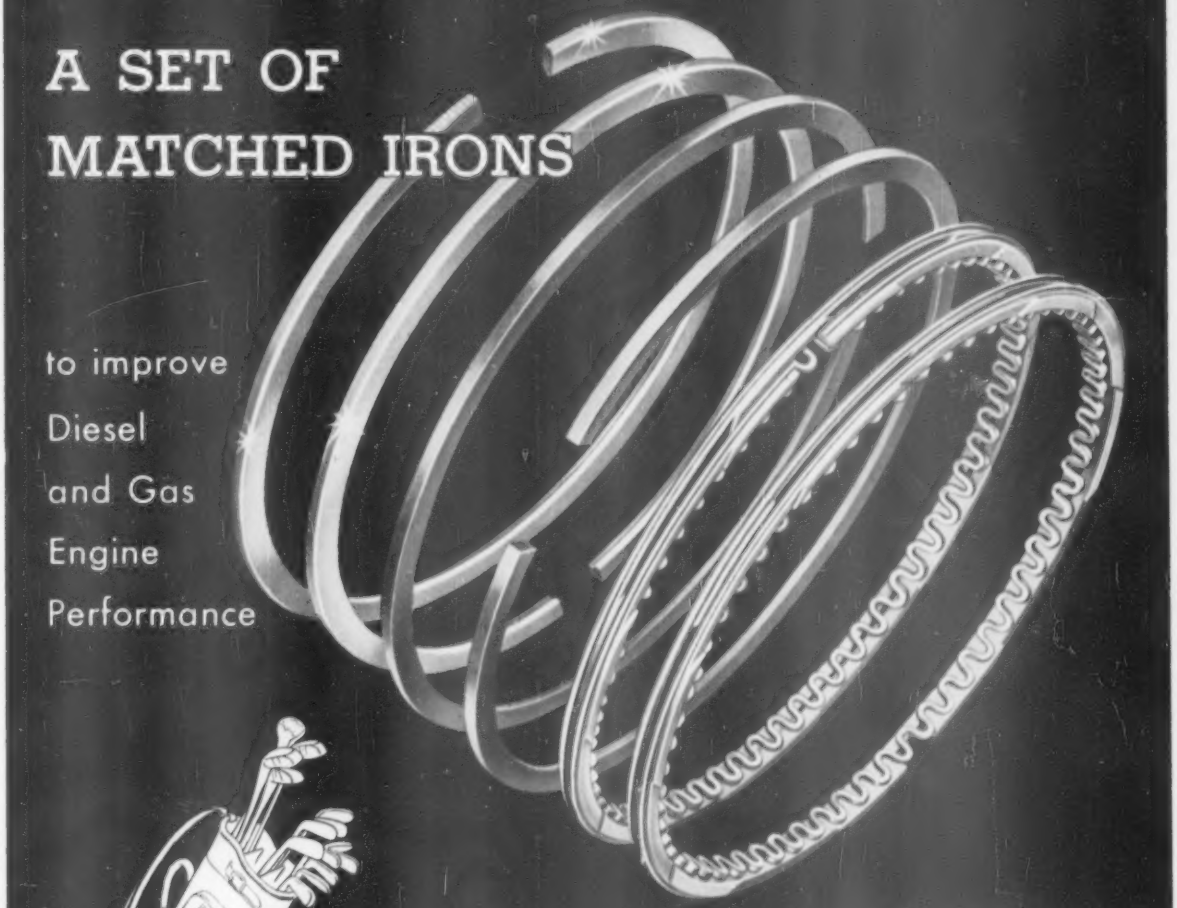
What makes a business a good citizen?

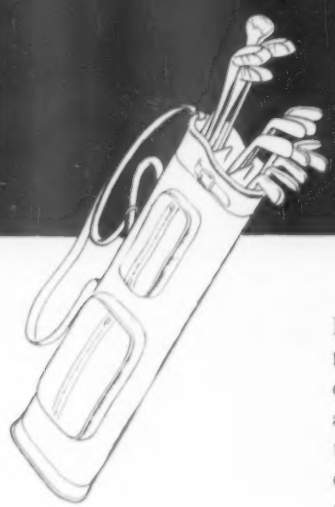
Constantly improving products and services for its customers. Several years ago Standard Oil established a program for a dealer advisory council to meet annually with us in Chicago and tell us, first-hand, how they and we can better serve our millions of customers. These men are selected by their fellow-dealers for their high qualities as independent businessmen—and they *do* tell us! We listen and we act whenever an improvement in products or services seems mutually practical. This seems to us a fine example of large and small business giving each other a helping hand and benefiting you, our customers, in the process.

STANDARD OIL COMPANY (INDIANA) STANDARD

A SET OF MATCHED IRONS

to improve Diesel and Gas Engine Performance





Like a golfer's set of matched clubs, each piston ring in a PEDRICK ENGINEERED SET is picked for its special ability to do its particular job more efficiently than any other ring. Consequently, PEDRICK ENGINEERED SETS are best able to meet the *individual* requirements of different engines. From top piston groove to bottom, PEDRICK RINGS deliver complete blow-by control, maximum lubrications with minimum oil waste, a more perfect seal for higher compression and longer life *plus* full power for every engine.

Whatever your requirements . . . engineered sets or single rings . . . you get more efficient performance when you specify PEDRICK PISTON RINGS. Engineering service is available to help you with special problems. Write, wire or phone: WILKENING MANUFACTURING CO., Philadelphia 42, SAratoga 9-3770

Pedrick **PISTON RINGS**

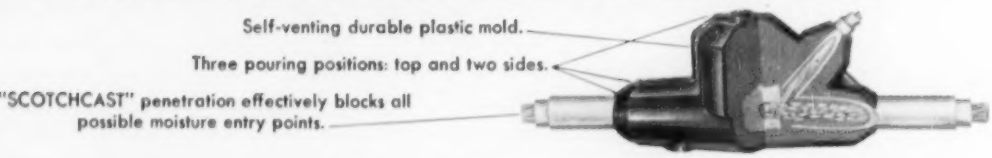
PEDRICK PRECISIONEERING KEEPS PEDRICK FIRST

Now anyone can make "Factory Tight" wye or tap splices in the field!

New "SCOTCHCAST" Splicing Kit gives maximum protection against moisture and electrial breakdown . . . solves splicing problems in rectifier ground bed installation

ALL MATERIAL for this revolutionary non-technical method of making wye or tap splice is included in new "SCOTCHCAST" Kit No. 90B1.

This cut-away view shows Factory-Tight "SCOTCHCAST" splice


Self-venting durable plastic mold.
Three pouring positions: top and two sides.
"SCOTCHCAST" penetration effectively blocks all possible moisture entry points.

"SCOTCHCAST" RESIN SPLICE KIT No. 90B1: for use in cathodic protection ground bed splicing, street lighting systems, traffic signal systems, or any place where the very best protection against electrical breakdown or moisture is a must. It offers the following advantages:

1. Complete moisture protection in weather-exposed locations, direct burial, including underwater use.
2. Thorough protection from mechanical and electrical stresses; uniform protection from splice to splice.
3. Ease and speed of application: an average field splice can be made in 10 minutes . . . even under adverse conditions.

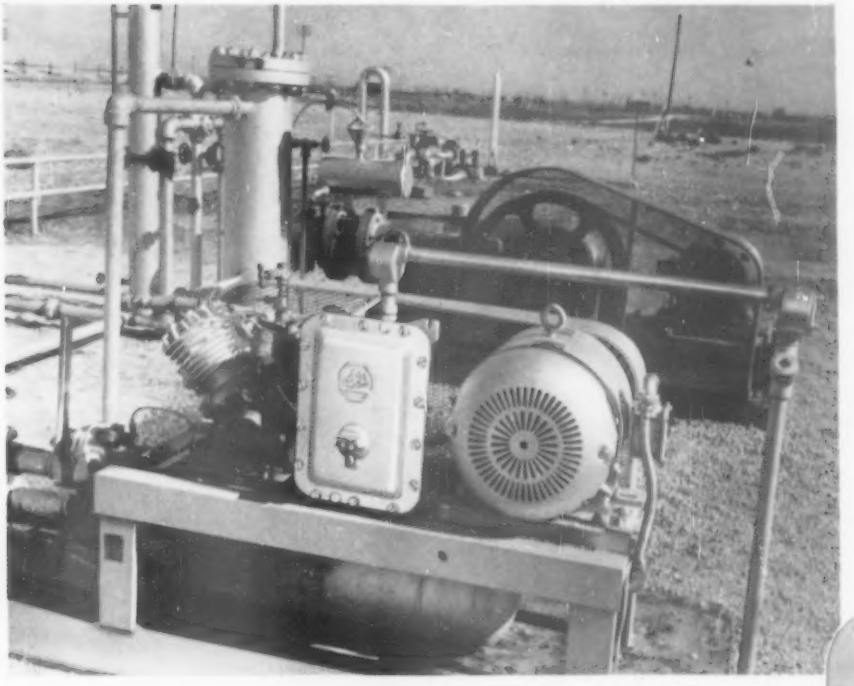
REG. U. S. PAT. OFF.

SCOTCHCAST
BRAND

For further information write on your letterhead to 3M Co., St. Paul 6, Minn., Dept. EU-56.

3M COMPANY

The term "SCOTCHCAST" is a registered trademark of Minnesota Mining and Manufacturing Co., St. Paul 6, Minn. Export Sales Office: 99 Park Ave., New York 16, N.Y. In Canada: P.O. Box 757, London, Ontario.



The Sign of
QUALITY
MOTOR CONTROL

Allen-Bradley Bulletin 709 Type 7 motor starter on a compressor at LPG loading terminal in Stanton, Texas.

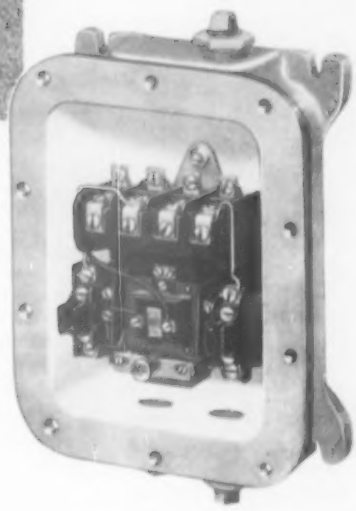
For GREATEST RELIABILITY and SAFETY

Install Allen-Bradley Starters in the Correct Enclosures

When you order a motor starter, be sure to consider carefully the type of enclosure required by the conditions under which the starter will be operating. Six of the more popular types are shown below.

For example, the Type 4 is watertight, weatherproof; Type 7 is for locations where hazardous gases may exist. For all ordinary conditions, the Type 1 general-purpose enclosure will prove completely satisfactory.

Since watertight and explosion-proof starters have heavy, bolted covers, inspection of the control becomes a big job. The surest way to cut down on the number of required inspections is to install Allen-Bradley solenoid starters. They have double break, silver alloy contacts that never need filing, cleaning, or dressing. With only ONE MOVING PART, A-B solenoid starters have no troublemaking parts. Install them . . . and forget them. Send for catalog.



Bulletin 709 solenoid starter in NEMA Type 7 enclosure for operating in hazardous gas locations.

A FULL LINE OF ENCLOSURES THAT WILL SATISFY EVERY OPERATING CONDITION

Type 1 general-purpose

Type 4 watertight & weatherproof

Type 7 explosion-proof

Type 8 corrosive & explosive gases

Type 9 hazardous dusts

Type 11 corrosion-proof

Allen-Bradley Co.
1304 S. Second St.
Milwaukee 4, Wis.

ALLEN-BRADLEY
QUALITY

In Canada—
Allen-Bradley Canada Ltd.
Galt, Ont.

These Smoother Running V-Belts Lower Your Operating Costs

Condor V-Belt engineering makes the difference. The strength member is micropositioned in heat dissipating rubber for a smoother running, cooler running drive . . . for longer life with the heaviest power loads. Condor V-Belt sidewalls are made *straight* to put positive pressure on the sheave grooves for more grip . . . less slip. Straight sidewalls help support the super-strength synthetic cords of the belt in a straight line so that *all* cords pull equally . . . deliver their maximum share of power. Controlled length is accomplished through pre-stretching during manufacture to remove inelastic stretch that might otherwise occur on the job.

NOW . . . Moisture-Proof Vacuum Packaging

R/M's exclusive new vacuum sealed moisture-proof packaging assures positive V-belt length control for users of longer lengths in C, D & E cross sections! Belts are measured at the factory under controlled humidity and identified for precise matching. They are then vacuum-sealed in moisture-proof aluminum lined bags. The result — no shinkage or elongation in storage . . . sustained uniformity on the drive! Length is *certified* from the factory to the field.

RAY-MAN CBL ROTARY HOSE

Write for Bulletin #6743, which tells you how you can get the highest safety factor, longest life and lowest cost per foot drilled . . . with Ray-Man CBL Rotary Hose.

R/M *Poly-V® Drive*

Bulletin #6638 describes how flat belt simplicity *plus* V-groove grip permits up to 50% more power delivery with R/M Poly-V*Drive . . . R/M's totally new concept of heavy-duty power transmission. Write for a copy . . . or contact your R/M representative.

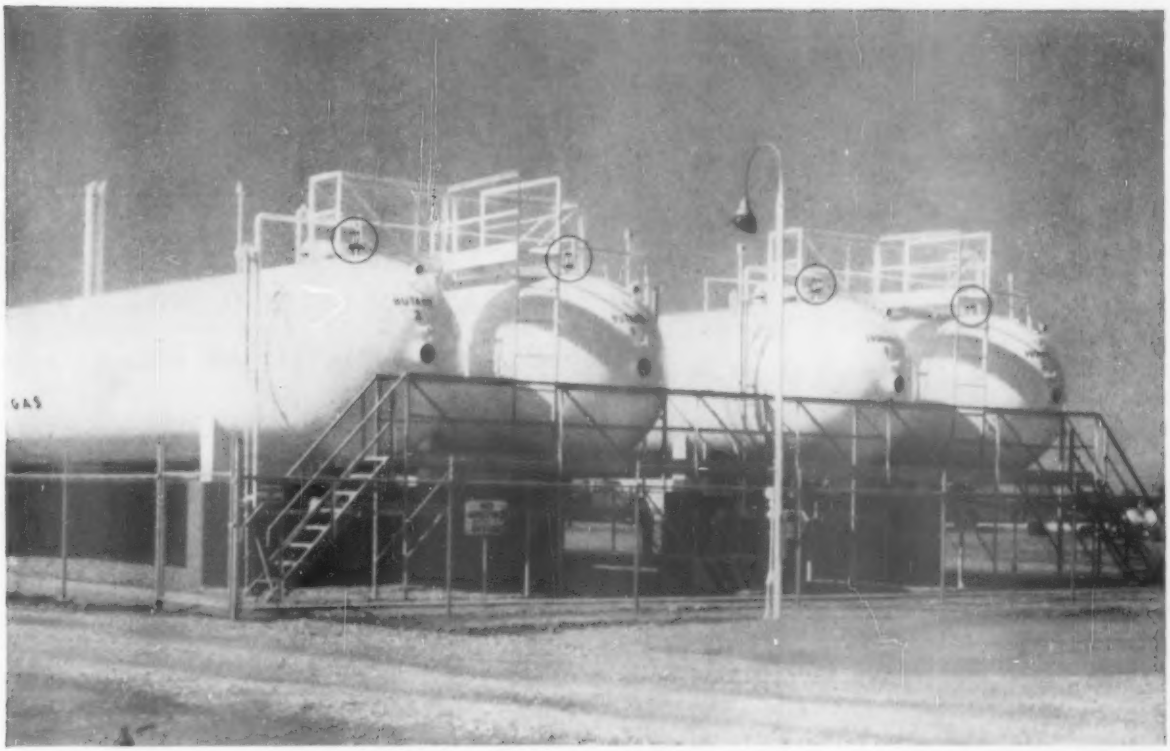
*Poly-V is a registered Raybestos-Manhattan trade-mark

RM 605-0

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Laundry Pads and Covers • Bowling Balls



A LARGE NATURAL GAS COMPANY IN TEXAS uses old salt domes as their new underground storage terminal. Rockwood Ball Valves are shown on the tanks used for receiving from the wells and loading in trucks or tank cars.

You load sixteen tons and what do you get?

. . . trouble-free service with Rockwood Ball Valves

It's a fact! Whether you load sixteen tons or sixty thousand gallons a day — you'll get trouble-free service with Rockwood Ball Valves.

That's not a boast it's a description. A description of how Rockwood Ball Valves operate. And there are four good reasons for it.

Full Round Flow — no change in shape or volume of fluid stream — no turbulence.

Quick Opening and Closing — only a quarter-turn needed.

Longer Wear-Resistance — chrome plated bronze ball withstands abrasion, pitting and scratching.

Leakproof Seal — pressure of fluid automatically positions ball against seat to form tight seal.

These are the features you want in a valve — these are the features you'll find only in Rockwood Ball Valves.

Send the coupon below for complete information. Rockwood Ball Valves come in all pipe sizes. Tested and listed by Underwriters' Laboratories, Inc. Distributors in all principal industrial areas.

ROCKWOOD BALL VALVES

FULL, ROUND FLOW

ROCKWOOD

ROCKWOOD SPRINKLER COMPANY
772 Harlow Street
Worcester 5, Massachusetts

Send me illustrated folder V-4 on Rockwood Full-Flow Ball Valves.

Name .....

Title .....

Company .....

Street .....

City ..... *Zone* ..... *State* .....

It's Easy with UNICOR®

TO AVOID CONTAMINATION OF PIPE LINE PRODUCTS

You get complete freedom from product contamination and at the same time economical protection for your pipe line when you use UOP UNICOR.

UNICOR is added only at the points of product entry, is distributed uniformly over the entire internal surface and effects 100% protection.

UNICOR is inexpensive to use, too. Actually, only one or two molecules of UNICOR are required for every 1,000,000 molecules of gasoline. This makes UNICOR's cost only about $0.0005/bbl. of pipe line product. There are additional savings, too, in reduced scraper-cleaning and filter replacement costs.

Our technical staff will be glad to assist you in the design, installation and operation of a UNICOR system of protection. Write us for information and samples.

PRODUCTS DEPARTMENT

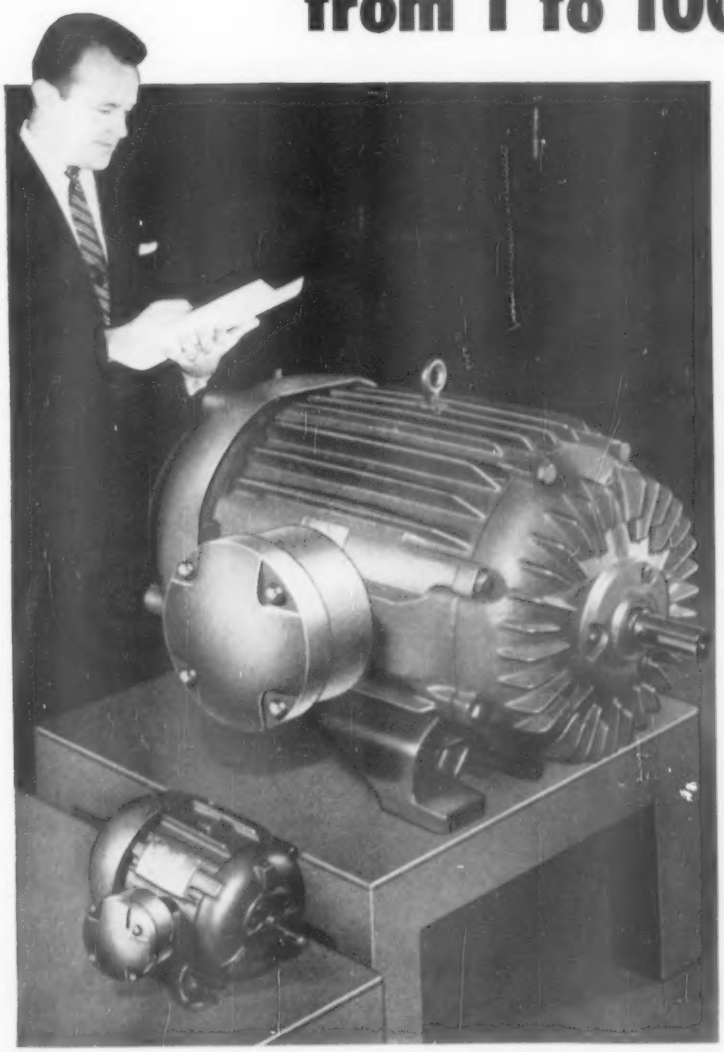
UNIVERSAL OIL PRODUCTS COMPANY

30 ALGONQUIN ROAD
DES PLAINES, ILLINOIS, U. S. A.

There's **MORE** rating selection available in Allis-Chalmers **MOTORS**

To meet refinery needs...

Allis-Chalmers Offers Complete Line of Rib-Type MOTORS from 1 to 100 Hp



Allis-Chalmers, a pioneer in rib-type TEFC motor design, is the only leading manufacturer offering a complete line of these motors from 1 to 100 hp. The many cost-saving features of deep-rib construction can be applied in a variety of uses . . . both indoors and out.

Here's why these motors can cut refinery costs:

MORE cooling surface — Rib-type design provides reserve cooling capacity in dirty locations.

MORE iron—Cast-iron frame and external parts assure rigidity and resistance to corrosion.

MORE copper — Allis-Chalmers greater use of copper increases electrical life.

MORE lubrication provisions — Large grease reservoirs surround bearings. Provision made for in-service relubrication — important where moisture or corrosive vapors contaminate grease.

As a new machinery component or as replacement, specify Allis-Chalmers. To find out more, contact your nearby Allis-Chalmers distributor, district office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

A-4963

ALLIS-CHALMERS

Water treatment gives you better pipe!

To give you quality line pipe that meets your exact specifications, every length of Kaiser steel pipe 20 inches and over is expanded by water under great pressure.

Hydraulic expansion increases the strength of Kaiser steel line pipe through additional cold working. This takes place within restraining dies assuring accurate diameter, concentricity, and straightness.

Add to this our *on-time delivery, wide range of sizes* and *prompt personal service* and it's clear why pipeline men know they can rely on Kaiser Steel.

Kaiser Steel

KAISER STEEL PIPE SPECIFICATIONS • All pipe manufactured to latest A.S.T.M. and A.P.I. specifications

Type	Diameter	Length	Wall Thickness	Shipping Point
Continuous Weld—Threaded and Coupled	½" to 4" nominal I.D.	Uniform 21'	Standard	Fontana, California
Continuous Weld—Plain End	2⅜" to 4½" O.D.	Up to 40'	Standard	Fontana, California
Electric Resistance Weld—Plain End	5⅝" to 12¾" O.D.	Up to 55'	.188" to .375"	Fontana, California
Electric Resistance Weld—Plain End	14" to 20" O.D.	Up to 40'	.250" to .500"	Napa, California
Electric Fusion Weld—Expanded—Plain End	20" to 30" O.D.	Up to 40'	.250" to .500"	Napa, California

Prompt, dependable delivery at competitive prices • KAISER STEEL CORPORATION Los Angeles, Oakland, Seattle, Portland, Phoenix, Denver, Tulsa, New York

DU PONT

PETROLEUM CHEMICALS DIVISION

NEWS

DU PONT

May ★ One of a Series of Bulletins for the Petroleum Industry ★ 1956

ONE COMPLETE LINE

Only Du Pont offers you a *complete* line of additives . . . for gasoline, for diesel and heating fuels, and for lubricating oils. Du Pont also offers grease stabilizers and dyes. To bring yourself up to date on the benefits of these products, read about them below and on the next page.

1. AN ASHLESS heating and diesel fuel oil additive. (See below.)
2. A NEW TYPE of lube oil additive that fills the growing need for low-duty detergency. (See below at right.)
3. COPPER CONTAMINATION in a wide variety of petroleum products can be controlled. (See article on Du Pont Metal Deactivator on next page.)
4. COLOR is adding new sales advantages to many petroleum products. (See next page.)
5. GREATER ECONOMY can result from purchasing Du Pont additives in carload lots. (Read about it on the next page.)
6. MULTI-PURPOSE greases for high temperature service require additional stability. (The Du Pont grease stabilizers written up on the next page can help you achieve it.)

ASHLESS additive to help you avoid oil burner and diesel troubles

Since it is a nonmetallic ashless additive, Du Pont Fuel Oil Additive No. 2 (FOA-2) does not leave a metallic ash deposit that can foul the operation of oil burner electrodes and stack controls. Also, it can be used in diesel fuels without any danger of contributing to exhaust sparking.

Many other advantages

Added to freshly prepared heating oil stocks at the refinery, FOA-2 retards the formation of insoluble residues in storage and customer tanks. It also reduces the particle size of any residues that are formed and helps to clean out any sludge deposits that might previously have formed in oil burner systems.

In diesel fuels, its stabilizing and dispersant action can help prevent injector sticking and filter plugging. In this way, FOA-2 provides a means of making economy grade, cat-cracked fuels highly acceptable for diesel operation.

New setup to expand customer service to refiners on Du Pont additives

The continuing upsurge in both volume and quality of petroleum products has increased the demand for all types of chemical additives. To meet this growing demand, the Du Pont Petroleum Chemicals Division has recently followed the lead established for TEL and streamlined its sales and technical service setup for the handling of all Du Pont additives.

J. J. MIKITA, right, Sales Manager, additives, and RICHARD O. BENDER, an Assistant Director of the Petroleum Laboratory, head up the new Petroleum Chemicals Division additives sales and technical service groups respectively.

A group under Mr. J. J. Mikita will have charge of the sale of Du Pont Metal Deactivator, gasoline antioxidants and dyes, fuel oil and lube oil additives, and grease stabilizers. In his former capacity as director of the Du Pont Petroleum Laboratory, Mr. Mikita had unusually broad experience in the development and application of all types of petroleum additives.

Mr. R. O. Bender, who has also been closely associated with the development of many Du Pont additives, will now be headquartered at the Du Pont Petroleum Laboratory. There, as an assistant director of the Laboratory,

To meet your need for low-duty lube oil detergents

Du Pont Lube Oil Additives 564 and 565 were especially developed to give effective detergency to motor oils for low-duty, around-town driving conditions. In addition to their detergency action, they will also add a substantial amount of your desired viscosity-index improvement.

Since a large part of the average motorist's driving is in stop-and-go city traffic, these unique additives offer you a strong promotional appeal for your motor oils.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

DU PONT

PETROLEUM CHEMICALS DIVISION
NEWS

DU PONT

CONTINUED *New Service Setup*

he will be able to closely coordinate the Laboratory's work with technical service for customers.

The new setup will provide thoroughly experienced personnel ready at all times to help refiners on both technical and commercial problems concerning the use of additives.

Together, these groups will devote their entire energies toward helping refiners make the most efficient use of Du Pont's complete line of additives for gasoline, diesel fuel, heating oil, lube oil, grease and other products.

Du Pont Metal Deactivator has wide range of valuable applications

In addition to gasolines, the list of products that can be improved with Du Pont Metal Deactivator (DMD) includes diesel fuels, home heating oils, kerosines, jet fuels, turbine oils, and greases.

Wherever copper contact is a possibility, there is danger of contamination and gum formation. But in most cases, a very small amount of DMD will supply adequate protection against the harmful effects of copper.

To help you take advantage of the benefits of Metal Deactivator in many different products, Du Pont offers comprehensive technical services. And these services are geared to your own individual needs and manufacturing operations.

Convenient laboratory help

The facilities and experience of the five Du Pont regional laboratories are an important part of these services. The laboratories may be able to help you put your whole additives program on a more economical basis.

For example—because combinations of DMD and other Du Pont additives often work more efficiently than one additive alone, the Du Pont laboratory recommendations can help you achieve your desired stability with less additive . . . often at a substantially lower treating cost.

Color helps you sell, identify, add interest to MANY petroleum products

Color is becoming a bigger factor in our everyday lives . . . and in the competitive struggle for sales. You see it in the cars on the street, in home decorating, in sport shirts at the beach.

It's important in petroleum products, too. Leaded gasolines have always been dyed. And many refiners have used gasoline dyes to match their pumps, station trim and brand identification signs. Many use it for sales promotion purposes in their motor oils, also.

TO GET the best results with Du Pont additives, you are always welcome to use the services of our conveniently-located regional laboratories.

Now greases and fuel oils are becoming more colorful. And the advantages of this go beyond the promotional value. Colored greases help service station personnel and industrial lubrication engineers identify the products and check their work. Fuel oils and other products can be readily identified by grade during pipeline shipments and at other points by the simple addition of color.

For adding these advantages to *all* your products, Du Pont offers a complete line of oil-soluble dyes—yellow, orange, red, blue and bronze. Their color stability is outstanding. And they are highly concentrated for economical use.

Grease stabilizers to meet varying requirements

As operating speeds and temperatures are pushed higher, grease stability is of increasing importance.

Du Pont "Ortholeum" 300 is highly effective as a metal deactivator, as well as an antioxidant. This quality is especially important in heavy-duty industrial greases which come in contact with bearings containing brass. It also provides unusually good resistance to color deterioration.

Du Pont phenyl-alpha-naphthylamine gives excellent results in most non-catalyzed systems. Where operating conditions are not too severe and competitive pricing is important, it can be used to increase stability at relatively low cost.

To help you save on cost of additives . . .

Du Pont additives are available in carload lots.

With Du Pont Antioxidant No. 22, for example, you can save about 6% by purchasing it in tank car lots. Such a saving can mean an important profit advantage to you. And we will be glad to ship these carload lots in special tank cars, equipped with steam coils to facilitate easy unloading.

DU PONT
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Better Things for Better Living
. . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.) *Petroleum Chemicals Division* • *Wilmington 98, Delaware*

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ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

A-1736

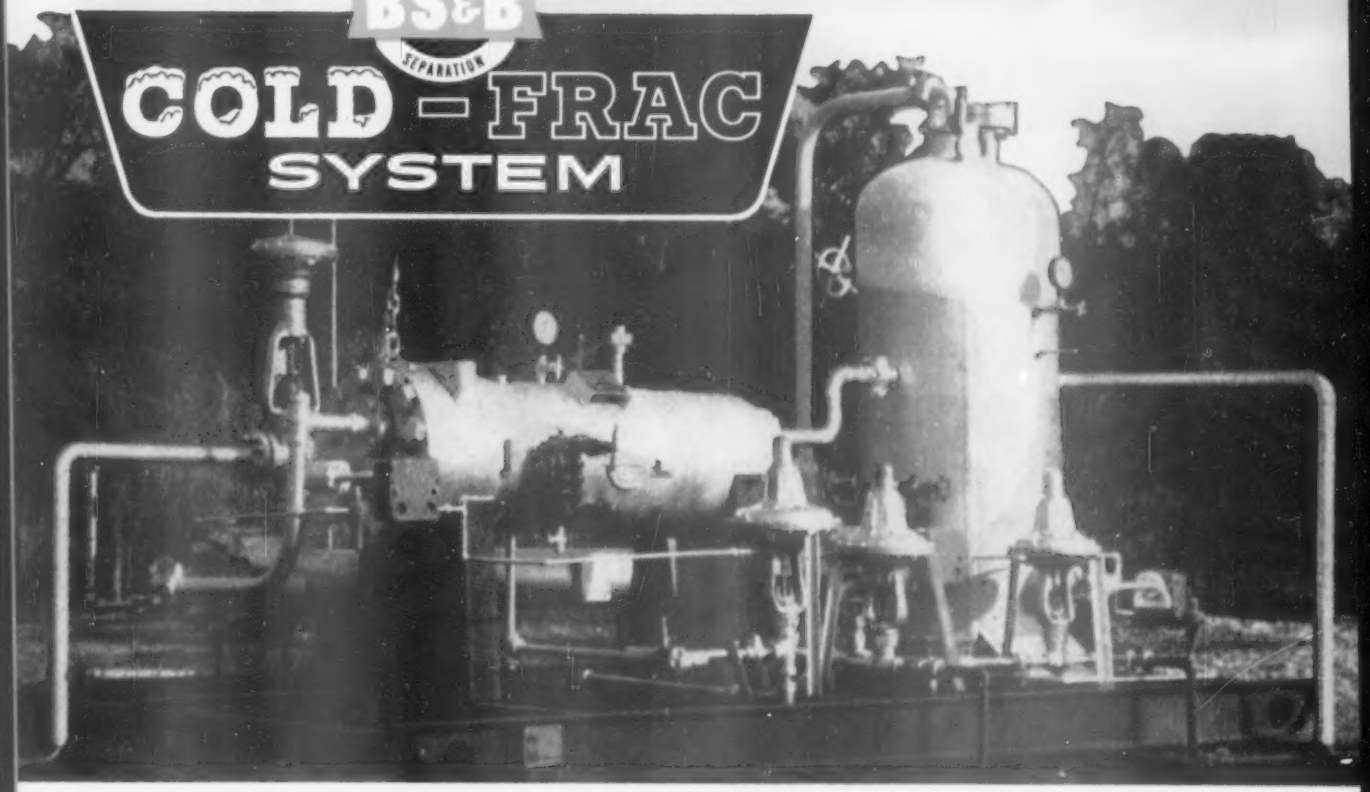
Printed in U. S. A.

Introducing...

The New BS&B Model MDH...

BS&B LOW TEMPERATURE SEPARATION

COLD-FRAC SYSTEM



Compactly Skid Mounted And Ready For Hook-Up!

The new BS&B Model MDH COLD-FRAC System is a completely packaged unit designed for service on high pressure gas condensate wells. Requiring only four field connections, it is available either with or without a second stage separator. Unsurpassed for economy, performance and freedom from operational troubles. Provides maximum return on your investment!

FEATURES

1. Designed For Optimum Recoveries Through Lower Temperatures.
2. Higher Separation Efficiency.
3. Reduced Operating Problems.
4. Less Space Requirements.

Your BS&B Representative Will Gladly Supply You With Detailed Information On The New BS&B Model MDH COLD-FRAC Unit, Or You May Write To...

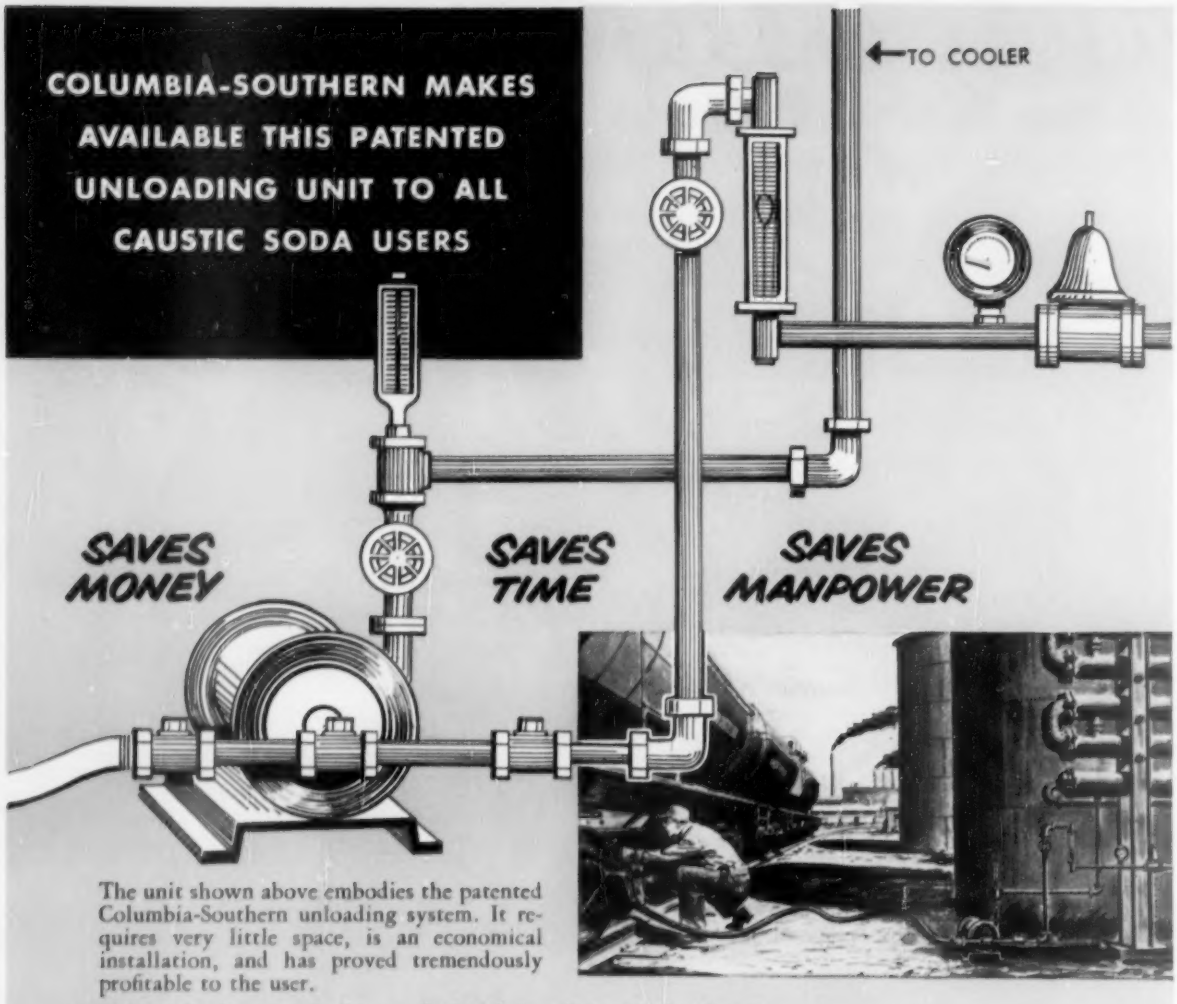
BS&B — OVER 60 YEARS — ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

BLACK, SIVALLS & BRYSON, INC.

Oil & Gas Equipment Division, Dept. 1-A5

1708 West Main Street — Oklahoma City, Oklahoma

COLUMBIA-SOUTHERN MAKES AVAILABLE THIS PATENTED UNLOADING UNIT TO ALL CAUSTIC SODA USERS



The unit shown above embodies the patented Columbia-Southern unloading system. It requires very little space, is an economical installation, and has proved tremendously profitable to the user.

This unloading method was designed by Columbia-Southern's technical staff and engineers in answer to the dire need of consumers for a simple, efficient system that would dilute 73% caustic soda to a 50% concentration before storage with quality maintained.

This patented method incorporates unloading and diluting in one continuous operation. It has proved so successful that Columbia-Southern is now making it available—royalty free—to all users of caustic soda.

Columbia-Southern has much data attesting to the substantial savings made possible in money, time and labor by switching from 50% to 73% and utilizing this patented method.

Columbia-Southern's Technical Staff will be glad to make recommendations on the placement of this unit, and they will be glad to help you with the installation of it as well as assist you with the unloading of your initial 73% shipment.

Contact our Pittsburgh office now for further information.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION

SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY

ONE GATEWAY CENTER · PITTSBURGH 22 · PENNSYLVANIA

DISTRICT OFFICES: BOSTON • CHARLOTTE • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • HOUSTON
MINNEAPOLIS • NEW ORLEANS • NEW YORK • PHILADELPHIA • PITTSBURGH • ST. LOUIS • SAN FRANCISCO

MUDDERS AND FAST HAULERS, TOO...

Mr. J. C. Duke, owner, and his son alongside the fleet of Macks used by Duke Transportation, Jena, La., for both heavy oil field and over-the-road hauling jobs.

Macks turn in outstanding performance 12 months of the year — both on and off highway

Here's what Mr. Duke writes:

"We operate oil field transportation equipment in an area that we consider the most unusual and roughest in Louisiana. This area, west of Natchez, Mississippi, is under water from late fall to early summer every year. Drilling rigs move in when the water moves out. No roads are built until oil comes in, which means that our trucks must haul heavy loads in and out of deep mud to supply drilling operations.

"In our constant search for heavy duty trucks that would work under these difficult conditions in the oil fields five months out of the year, and during the remaining seven months compete on over-the-road hauling jobs, we have used trucks of many makes and models.

"In 1950, we purchased our first Mack. Since then we have added 10 more heavy-duty Macks because we've found that they can be depended upon to turn in top performance on every job. Large or small, our Macks give us the speed, ease of operation, fuel economy, versatility and long service life that enable us to equal or better our over-the-road competition. And of course Macks are in a class by themselves when the going's rough and muddy."

Here's why Macks deliver such outstanding performance:

- Mack's famous Balanced Bogie and exclusive Power Divider deliver torque to each wheel in proportion to its traction. Macks are the trucks that don't mire in when mud is extremely heavy.
- Mack's Thermodyne® Diesel engine is unsurpassed for fuel operating economy.
- Mack's rugged construction and ready accessibility are among the many features that add up to outstanding performance and easy maintenance even on the toughest jobs.

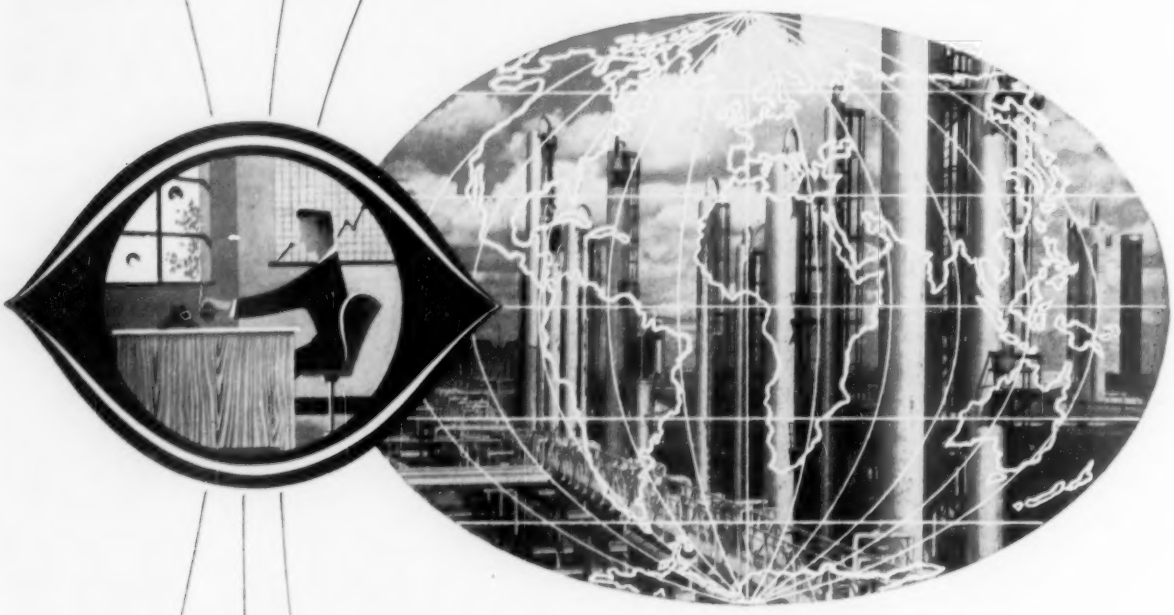
Let your Mack Branch or Distributor give you complete details. Mack Trucks, Empire State Building, New York 1, N. Y.

MACK
first name for
TRUCKS

3902

Newalls

OFFERS TECHNICAL SERVICE ON SITE



NEWALLS ARE CONSTANTLY solving insulation problems all over the world. From Antwerp to Adelaide, Newalls insulation materials are meeting every requirement in Heat, Cold and Sound Insulation. But Newalls service offers more than the supply of materials.

Newalls can also provide supervisory service to smooth out application difficulties on site. Newalls technical staff can handle the specifications and estimating work for any kind of plant, large or small. Calling on Newalls Technical Advisory service is the quickest way to insulation efficiency.

OIL REFINERIES for which Newalls have supplied insulation materials include the following:

BELGIUM
- * Petrofina, Antwerp
- * Esso Antwerp
- * Albatros Antwerp

BRAZIL
- * Cubatao

FRANCE
- Port Jerome
- Du Nord (Dunkirk)
- Gonfreville
- Petite Couronne
- Berre

INDIA
- * Stanvac, Bombay

MIDDLE EAST
- * Aden
- Ras Tanura
- Bahrain

VENEZUELA
- Cardon
- * Amuay

* Insulated wholly with Newalls Insulation Company Limited's materials.

Newalls

TECHNICAL ADVISORY SERVICE

NEWALLS INSULATION CO. LTD.,

Head Office: Washington, Co. Durham, England

A member of the TURNER & NEWALL ORGANISATION

Agents and Vendors in most markets abroad.

They Say—

Future Shadowy?

"As long as free competition exists, the oil industry in the years ahead will continue to furnish all the oil our economy will demand, and at prices the economy can afford.

"If utility controls stay on the natural-gas producers—if, as could all too easily happen under such circumstances, those controls are extended to oil producers—then the answer to the question of supply may be no.

"Oil is becoming increasingly difficult and constantly more costly to find in the U. S. But as long as competition continues to serve as a governor, the prices will remain reasonable. . . .

"With all the conviction I can muster, I'm sure this is our best avenue toward progress. But over the years, some groups have tried to force into the petroleum equation those other factors—the governmental. That's the one consideration that makes the entire future shadowy."

William H. Miller, Chicago, assistant general manager of sales promotion and advertising, Standard Oil Co. (Ind.), in address before the Council of Agriculture and Chemurgic Research Conference in Chicago.

Women in Engineering

"The general type of individual in the (engineering) profession will be much the same, although he may, by the way, be a female. Fifty years from now the pressure of community requirements for engineers will be such that womanly intuition will undoubtedly be added to the graces of the profession . . .

"The demand for great solutions to great problems will make more scarce the lone wolf in the profession. In order to meet the requirements of the future, it is very likely that engineers must work in teams. It is equally probable that the teams may consist of pure professionals assisted by those who are technically inclined but who perhaps have not the desire to become inbued with a the consciousness of the mathematical and scientific approach.

"In engineering teams of this sort, it will be expected, there will be a great number of womenfolk. No longer will it be the sole aim of an attractive young thing to spend a few years as the boss' secretary and then to retire, as she should, to the chore of raising a family. It is equally possible now

"...rotary table expert...huh!"

Another record in drilling activity is shaping up for this year . . . and the greatest gain in wells drilled will be made by Lone Star Steel's neighbors in Texas, Louisiana, Oklahoma, Kansas and nearby states. The use of Lone Star pipe is setting a new record, too.

Lone Star's casing, tubing and line pipe are manufactured to API standards. The huge Lone Star Steel plant operates for the special convenience of Joe Roughneck, heart of the oil industry. Whether Joe is doing a rugged job on a rig in the field . . . or whether he has become president of his company . . . he's the man who knows oil and pipe. He knows Lone Star is his dependable supplier.

Neighbor, wherever you are, specify Lone Star and we both get a good deal.

Lone Star STEEL COMPANY

LSS

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Houston, Texas | Midland, Texas | San Antonio, Texas
Tulsa, Oklahoma | Wichita Falls, Texas | Shreveport, La.

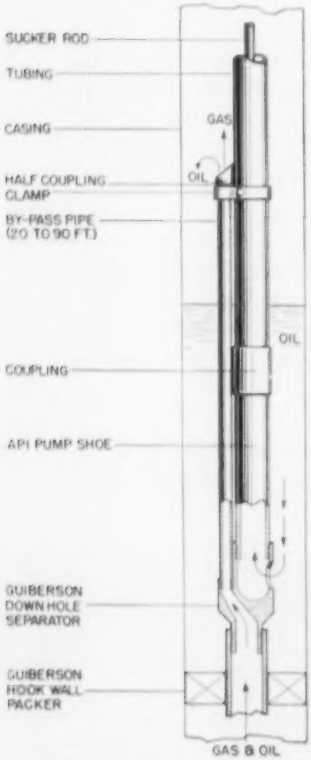
Answer To An Old Problem!

DOWN HOLE SEPARATOR

for pumping wells

Down Hole Separator

The Guiberson down hole separator increases production and eliminates the problem of gas locks, etc., in pumping wells where the produced fluid has a high gas/oil ratio. Less than a foot in length, the separator is screwed directly into a Guiberson packer and the pump shoe fitted directly onto the separator. One to four joints of by-pass pipe, depending upon the producing characteristics of the well, are screwed into the separator and clamped to the tubing. Attached to the top of the by-pass pipe is a half-coupling cut on a diagonal which guides the unit past casing joints. By-pass pipe hugs the tubing as snugly as couplings permit. Production crosses over from the tubing below the packer into the annulus above it and is carried well above the pump shoe by the by-pass pipe. The large annulus above the packer allows the gas to break out of solution and the oil drops back to the large reservoir above the packer where it is picked up by the pump, comparatively free of gas. The separated gas is bled off of the casing continuously. Intake ports on the separator have a larger by-pass area than the tubing. The separator is precision machined from cast steel.



Schematic Installation

ENGINEERING DATA

Part Number	Minimum Casing O.D.	Tubing Size And By-Pass	Maximum Metal O.D.	Approximate Weight	Approximate Length
29439	4½"	2" x 1½"	3¾"	12#	13¾"
29133	5"	2" x 1½"	4⅛"	14#	10½"
28369	5½"	2" x ¾"	4½"	15#	10⅛"
28645	5½"	2" x 1"	4½"	15#	10⅛"
29606	5½"	2½" x ¾"	4½"	15#	16"
28370	7"	2½" x 1"	5⅝"	20#	11⅛"

Note: The 4½" x 2" and 5½" x 2½" sizes have NUE 10 round top and EUE 8 round bottom field connections; all other sizes are EUE 8 round both ends. When ordering specify part number, casing, tubing and by-pass size.

THE
GUIBERSON
CORPORATION
ESTABLISHED 1919 • DALLAS, TEXAS, U. S. A.
Sold By Leading Oil Field Supply Stores Everywhere

that the attractions of science and computation will draw into the technical field many girls who will spend their premarital life in the service of engineering, following, perhaps, the intellectual leadership of an engineer who directs the team approach."

M. D. Hooven, president of American Institute of Electrical Engineers, in address before Great Lakes District of A.I.E.E., at Fort Wayne, Ind.

Drilling Too Much?

"There is, in a very real sense, no market outlet for all the wells you can drill this year and no market for all the oil you can produce.

"Each dollar invested in a new well is going to lower the rate of return on some dollar already invested. What good is a high rate of return on a new well if it reduces the rate of return on the wells already drilled? Each barrel of reserves drilled today defers the date at which some other barrel of reserves will be produced, and a barrel of reserves which won't be produced for 10 years doesn't buy Cadillacs or mink coats for the owner . . .

"Many producers are fooling themselves with the wells they are drilling today. The payout may look reasonable and the return on investment acceptable; but unless due consideration is given to the future market picture, these wells may find themselves without adequate outlets. It must be remembered that the wells drilled today, as well as existing wells, are going to have to continually move over to make room for new wells.

"Many companies have been literally spinning their wheels in the last few years, spending millions of dollars simply to maintain their relative position, the same position they would have had if every producer had spent proportionately less.

"The laws of supply and demand are not to be mocked by governments, politicians, companies, or individuals. When you produce an unneeded facility or tamper with a free price, sooner or later that facility or that price will return to haunt you. We must use restraint in expanding our operations and assume our responsibility as members of a great and vital industry.

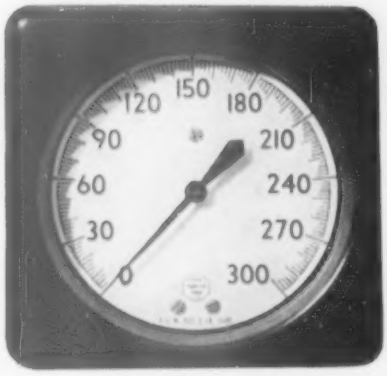
"The question of what to do in place of drilling more oil wells naturally arises when a reduction in drilling is suggested. The answer to this must be worked out on an individual basis. Many companies, seeing the handwriting on the wall, have diverted part of their funds to petrochemical operations. Others have spent large sums of money seeking oil abroad: a mixed blessing when the question of imports arises.

"One important course of action that I can recommend to most operators is

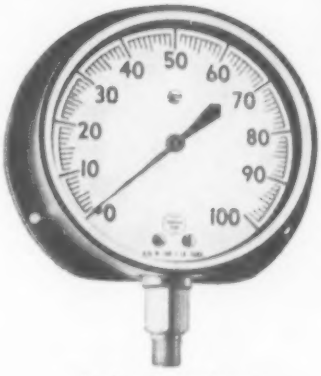
ACCO products

Helicoid Gages

Long-life gages to meet every pressure indicating requirement



Acaloy square case for flush mounting



Acaloy flanged case

For pressure, vacuum or compound service

Ranges from 15 to 20,000 p.s.i.

Tubes of bronze, alloy steel, stainless steel and K Monel for all types of gas or liquid.

Cases are flanged, flangless, flush mounted, square or circular and with white or black dials.

Chemical gages with diaphragms to seal off objectional substances from indicating gage.

Chemical gage with black dial

Only HELICOID has the HELICOID movement

All HELICOID Gages provide the sustained accuracy that only the famous HELICOID—no gears—movement provides.

Write today for the HELICOID G-2 CATALOG

ACCO

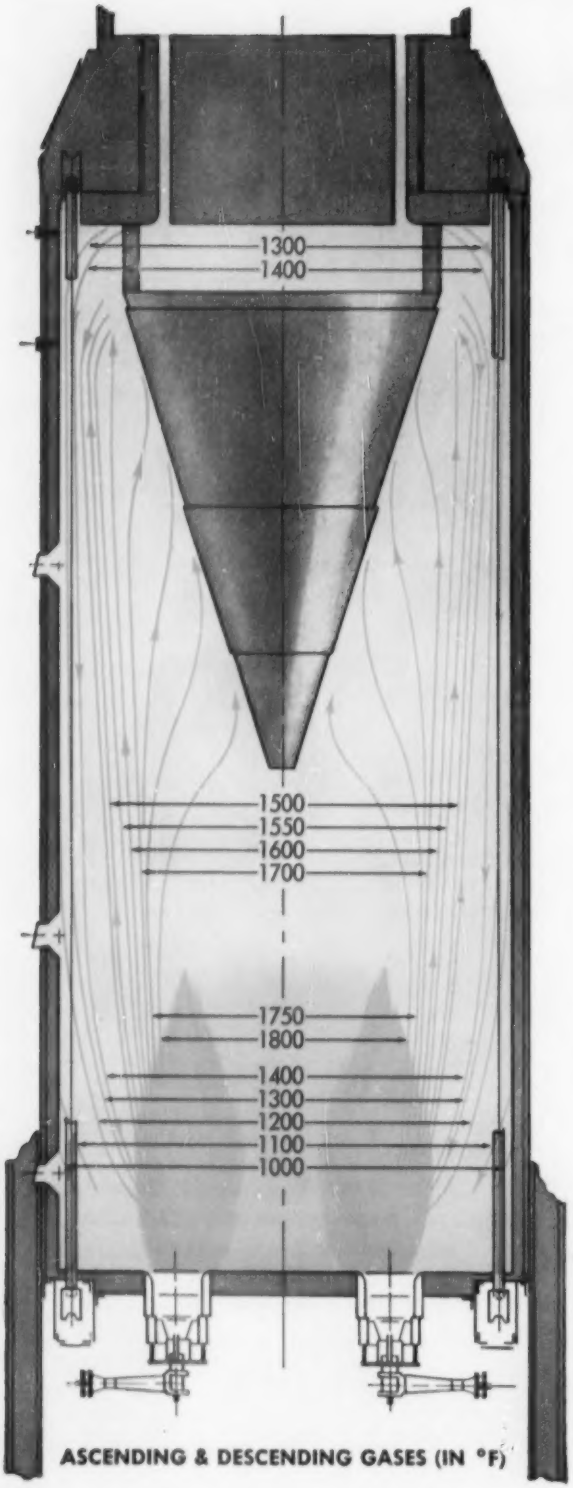
Helicoid Gage Division

AMERICAN CHAIN & CABLE

929-A Connecticut Avenue • Bridgeport 2, Connecticut

Better Value

PETROCHEM-ISOFLOW FURNACES



ASCENDING & DESCENDING GASES (IN °F)

Here are the facts!

The first vertical cylindrical heaters provided even circumferential heat input, but vertical flux distribution varied considerably, from high transfer at the bottom of the tubes to low rates at the top. Improvements in design during the past twenty years have overcome this difficulty, by providing proper firebox proportions, a reradiating cone, and burners specifically designed to the requirements of the furnace.

It is significant that *only Petrochem-Isoflow furnaces* incorporate all three of these critical items of design.

The small, hot cone tip reradiates to the tubes, across a considerable distance. Because of the conical shape employed, each higher element of the cone is of larger area, and closer to the tubes than the section below. These factors compensate for decrease in cone temperature from tip to base, provide relatively constant radiant heat transfer over entire upper tube length.

The cone also serves to divert flue gases along the upper ends of tubes, which adds convection heat transfer over this length. It also initiates a high rate of firebox recirculation of combustion products, by cooling the gases in their passage across the tubes.

Being cooler, and therefore heavier than the rising gases in the center of the firebox, the gases adjacent to the tubes fall to the bottom of the heater by thermal siphon effect, increasing the heat input to the rear of the heating elements by convection. The descending gases also serve as a buffer between hot gases and the lower ends of the tubes and dilute the products of combustion. The special burners, by developing a symmetrical flame pattern, contribute to the equality of heat distribution over the entire radiant tube length.

Of the design features mentioned above, the cone is of the greatest significance because it is essential to even radiant heat distribution.

Experienced operators know that even heat distribution improves product quality, decreases tube deteriorations, results in longer, trouble-free operating cycles.

The Data Shown in the Drawings are ACTUAL PERFORMANCE RECORDS!

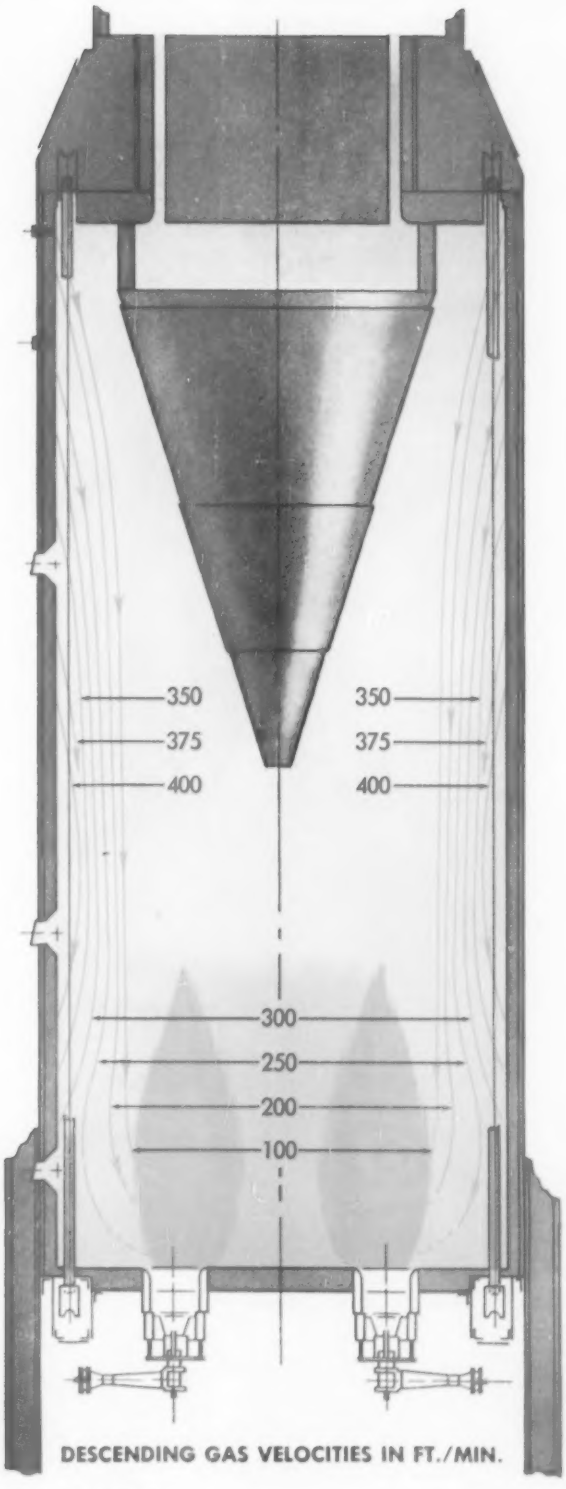
To check radiant flux distribution in Petro-Chem furnaces, exhaustive tests were made under actual operating conditions; some of the results of these tests are indicated in the two adjacent drawings.

Left: Plot of isotherms in a Petrochem-Isoflow firebox, illustrating the uniformity of firebox temperature.

Right: Plot of flue gas flow patterns and velocities, demonstrating the high gas recirculation rates.

Both of these phenomena are the result of proper firebox proportions, the two-fold action of the cone, and symmetrical flame pattern.

Provide EVEN HEAT Distribution !



DESCENDING GAS VELOCITIES IN FT./MIN.

In addition to even heat distribution, other all-important factors which determine the value and efficiency of processing furnaces include:

MAXIMUM FUEL EFFICIENCY
PLENUM CHAMBERS FOR HAZARDOUS AREAS
SIMPLICITY OF DESIGN AND CONSTRUCTION
EXCESS DRAFT FOR HIGH OVERLOAD
EXPLOSION RESISTANT
MINIMUM GROUND SPACE
SHORT LENGTH OF LIQUID TRAVEL
ZERO AIR LEAKAGE
LOW PRESSURE DROP
LOW MAINTENANCE

In every case where these 11 all-important design characteristics were employed to compare one type of furnace design with another, PETROCHEM-ISOFLOW FURNACES were proved more economically desirable by any comparison.

More than 1350 Petrochem-Isoflow Furnaces have been installed since 1930—an unequalled record of acceptance based on proved performance.

PETROCHEM
—ISOFLOW FURNACES

UNLIMITED IN SIZE . . . CAPACITY . . . DUTY

PETRO-CHEM DEVELOPMENT COMPANY, INC.
122 East 42nd Street, New York 17, N. Y.

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Rawson & Co., *Houston* • William H. Mason Co., *Tulsa* • Lester Oberholtz, *Los Angeles* • Faville-Levally, *Chicago* • D. D. Foster, *Pittsburgh* • Turbex, *Philadelphia* • Flagg, Brackett & Durgin, *Boston* • G. M. Wallace, *Denver & Salt Lake City*

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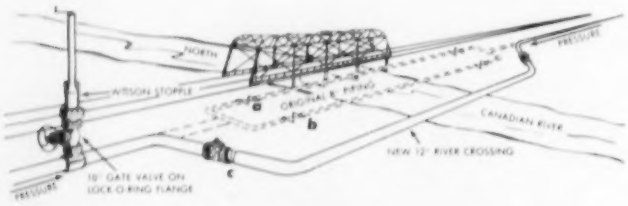
OKLA. NATURAL GAS RELOCATES 10" LINE *without* INTERRUPTION OF SERVICE

OKLAHOMA NATURAL GAS COMPANY MAINTAINED GAS SERVICE TO OKLAHOMA CITY CUSTOMERS WHILE RELOCATING A SECTION OF PIPELINE CROSSING THE NORTH CANADIAN RIVER . . .

HERE'S HOW THE JOB WAS DONE

① TWO 10" FLANGED SPLIT-TEES WERE WELDED TO THE LINE ON EITHER SIDE OF THE RIVER



② TAP WAS MADE WITH WmSON-HILLCO MODEL 660 TAPPING MACHINE

③ WmSON STOPPLE REPLACED TAPPING MACHINE ON CLOSED VALVE

④ LINE WAS PLUGGED ISOLATING SECTION BETWEEN STOPPLE AND VALVES a. & b. (CITY LOOP SYSTEM MAINTAINED SERVICE TO RIVER FROM EACH SIDE.)

⑤ ISOLATED SECTION WAS THEN CUT AND NEW 12" CROSSING TIED INTO 10" LINE

⑥ FOR REMOVAL OF VALVE, LOCK-O-RING PLUG WAS INSTALLED IN L-O-R FLANGE WITH TAPPING MACHINE

⑦ TAPPING MACHINE AND GATE VALVE WERE REMOVED AND BLIND FLANGE INSTALLED

THIS ENTIRE OPERATION WAS THEN REPEATED ON THE OPPOSITE SIDE OF THE RIVER

Write for RENTAL-PURCHASE information

T. D. Williamson, Inc.

P. O. BOX 4038 TULSA 9, OKLAHOMA

REPRESENTATIVES: Houston • Pittsburgh • Plainfield, N. J. • Amarillo • Casper • Provo, Utah • Joliet, Illinois • Los Angeles • San Francisco • Bartlesville, Okla. • Edmonton • Toronto Calgary • Buenos Aires • Durban, Natal, South Africa

an increase in exploratory drilling, and by exploratory drilling I do not mean merely extension wells, but real new-field wildcats."

Ralph O. Dietler, oil consultant, Tulsa, Okla., in address before Rocky Mountain district of A.P.I. Division of Production, Denver.

Canadians Need a Break

"As to export markets, the Canadian exporter is at a disadvantage in competing with the American producer. The present import tax into the U. S. is 10½ cents a barrel on light crudes, whereas Canada allows the importation of crude oil free. The situation may require joint consideration by both the U. S. and Canadian governments to arrive at a mutually satisfactory solution.

"Production obtainable in the U. S. has two considerations in its favor which do not apply to Canada. First, the present market proration in Canada means an appreciably longer pay-out period with low production rates compared to reserves available. In the U. S. the ratio of production to reserves is about double the Canadian ratio. Secondly, the Canadian tax legislation applicable to the petroleum industry, particularly in the matter of depletion allowances, does not afford adequate incentive for development activities by the industry. With respect to depletion allowance, it would be our suggestion that present Canadian income tax regulations should be amended, so that, in computing income subject to depletion, only expenses incurred in respect to producing properties should be deducted from the income from production obtained from those properties."

M. S. Beringer, president, British American Oil Co., Ltd., in address to general meeting of shareholders, Toronto.

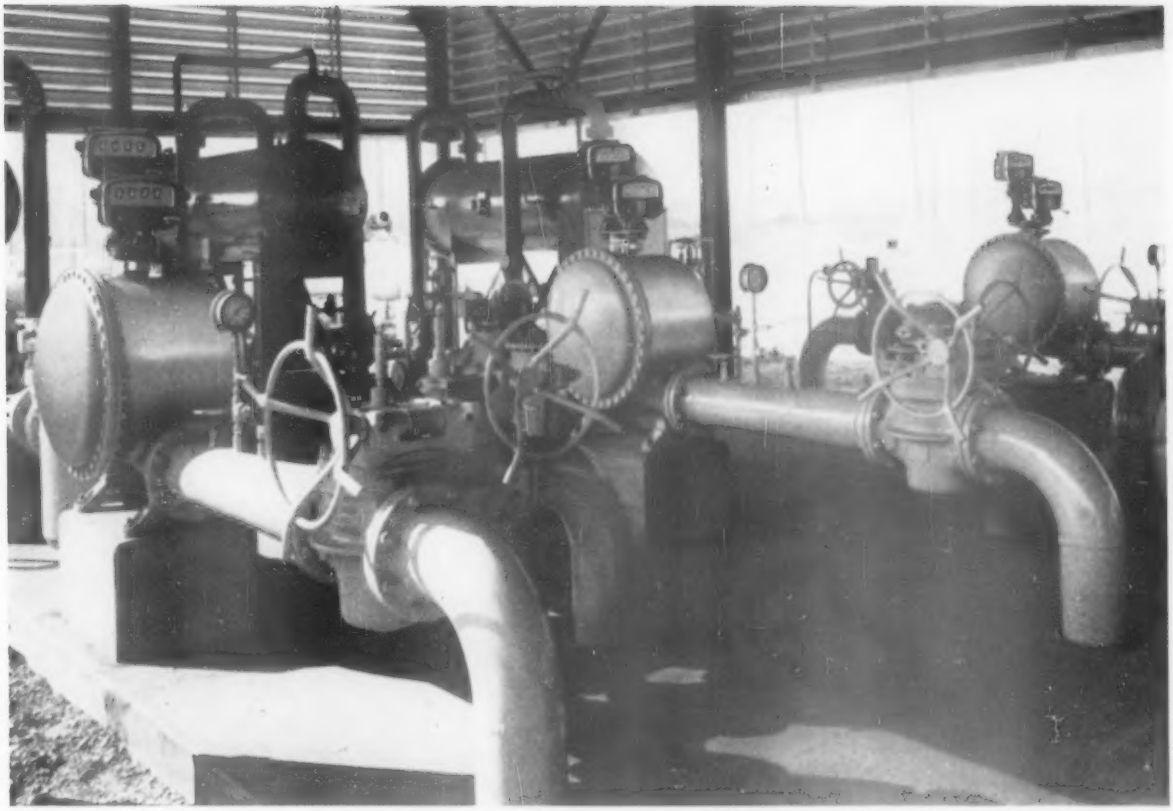
CALENDAR OF EVENTS

MAY

9-10 National Association of Corrosion Engineers, Niagara frontier section, symposium on control of corrosion in the chemical industry, University of Buffalo.

9-11 Canadian Institute of Mining & Metallurgy, Petroleum and Natural Gas division, seventh annual technical meeting, Palliser Hotel, Calgary.

10-11 American Petroleum Institute, Division of Production, Pacific Coast district meeting, Statler Hotel, Los Angeles.



Three Brodie Meters, each with 1800 bbl/hr capacity, are shown at the Watson station. Additional Brodie Meters are at Norwalk, Phoenix, Colton and Niland.

Brodie Meters on new 844-mile products line point up efficiency, control, and accurate records

On the new Southern Pacific Pipe Lines, Inc. installation between Los Angeles and El Paso, Brodie BiRotor Meters at western segment pumping stations and distribution take-off points are employed to provide accurate measurement and records of various products. The 8" to 16" line was designed by Engineering Management Inc.

The Watson, California station pictured above illustrates use of the Brodie Dual Counter System. This allows instant switching from one counter to another without stopping flow between tenders or product changes. The operator can then print the record of the previous tender at his convenience. This is typical of modern methods employed throughout this $30 million products line—the first built by a railroad—and first to carry products out of California.

Sustained accuracy and low maintenance is daily proving the advantages of Brodie BiRotors—wherever petroleum is metered.

BRODIE ALL-STEEL BiRotor TRUE ROTARY METERS

RALPH N. BRODIE COMPANY · San Leandro, California, U.S.A.

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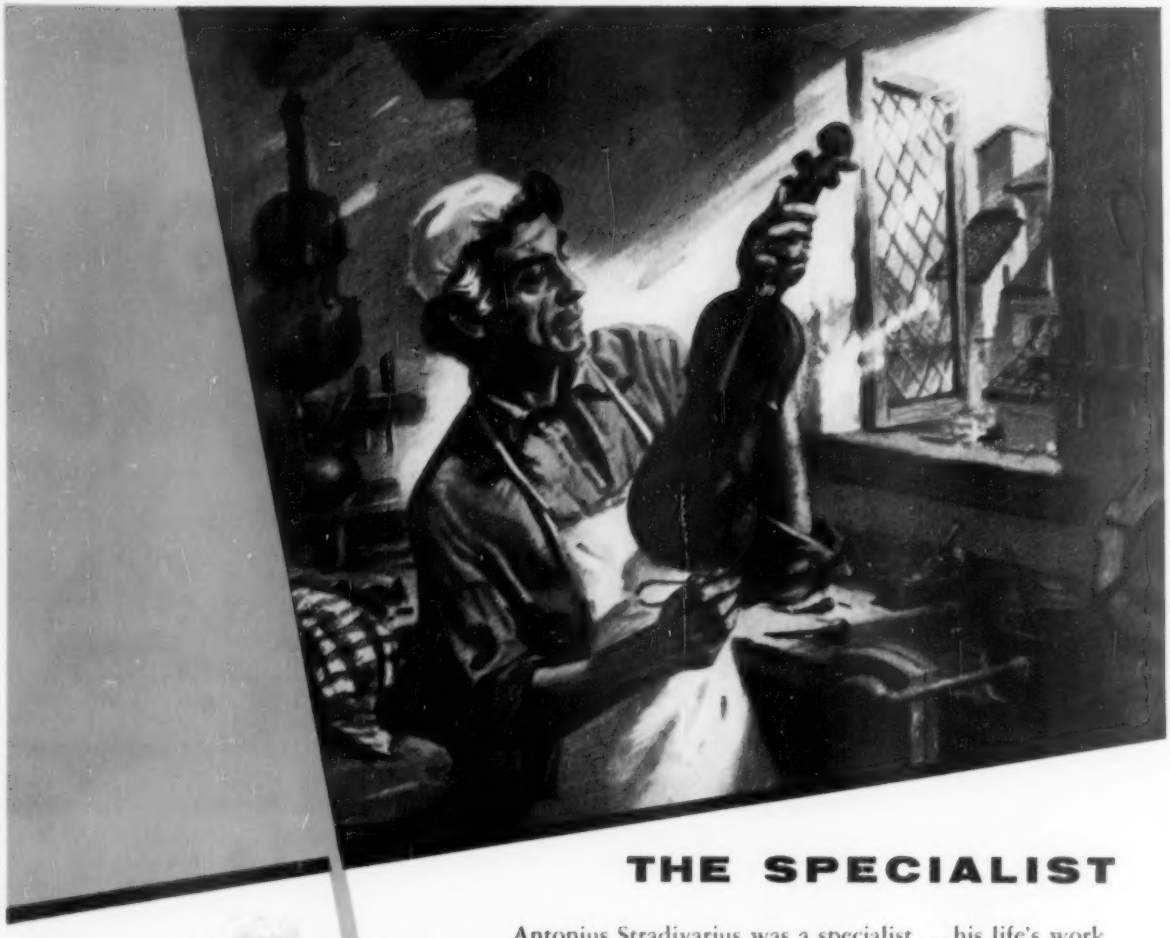

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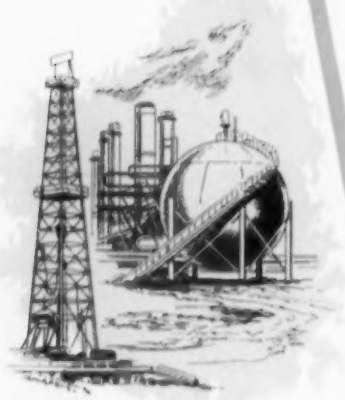

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10-11 American Gas Association, Gas Supply, Transmission, and Storage Conference, Conrad Hilton Hotel, Chicago.

13-15 Empire State Petroleum Association, Statler Hotel, Buffalo.

14-15 American Institute of Mining, Metallurgical & Petroleum Engineers, Kansas regional meeting, Broadview Hotel, Wichita.

14-16 American Petroleum Institute, annual pipeline conference, Shamrock Hotel, Houston.

14-16 Petroleum Electric Power Association, eighth annual convention, Robert Driscoll Hotel, Corpus Christi.

14-17 American Petroleum Institute, Division of Refining, midyear meeting, Montreal.

16-18 American Gas Association, Chemical, Engineering, and Manufactured Gas Production Conference, Benjamin Franklin Hotel, Philadelphia.

17-18 Rocky Mountain Petroleum Sections, American Institute of Mining, Metallurgical & Petroleum Engineers, Gladstone Hotel, Casper, Wyo.

22-24 Pennsylvania Gas Association, Pocono Manor Inn, Pocono Manor, Pa.

24-25 Natural Gas and Petroleum Association of Canada, Sheraton Brock Hotel, Niagara Falls, Ont.

24-25 Kentucky Oil and Gas Association, annual meeting, Lafayette Hotel, Lexington, Ky.

24-25 Western Petroleum Refiners Association, Michigan Regional Meeting, (location to be announced).

28-30 Chemical Institute of Canada, 39th annual conference and exhibition, Sheraton-Mount Royal Hotel, Montreal.

30-June 1 Texas College of Arts & Industries, eleventh annual short course in Gas Technology, Kingsville, Tex.

30-June 2 Interstate Oil Compact Commission, Dallas.

JUNE

3-8 Society of Automotive Engineers, summer meeting, Chalfonte Haddon Hotel, Altantic City, N. J.

6-8 American Society for Quality Control, tenth annual convention, Palais du Commerce, Montreal.

10-15 American Petroleum Institute, Production Division midyear standardization conference, Brown Palace and Cosmopolitan Hotels, Denver.

11-15 American Institute for the Advancement of Science, Gordon Research Conference on Catalysis and Petroleum, Colby Junior College, New London, N. H.

13 Pennsylvania Grade Crude Association, thirty-third annual meeting, Bradford, Pa.

17-22 American Society for Testing Materials, annual meeting, Chalfonte-Haddon Atlantic City, N. J.

17-23 World Power Conference, Vienna.

21-22 Western Petroleum Refiners Association, regional technical—industrial relations meeting, Broadview Hotel, Wichita.

21-23 American Association of Petroleum Landmen, annual convention, Denver.

26-29 Canadian Gas Association, Manoir Richelieu, Murray Bay, Que.

28-30 Rocky Mountain Oil and Gas Association, board of directors, Hotel Utah, Salt Lake City.

JULY

9-11 American Gas Association, American Petroleum Institute, Canadian Petro-

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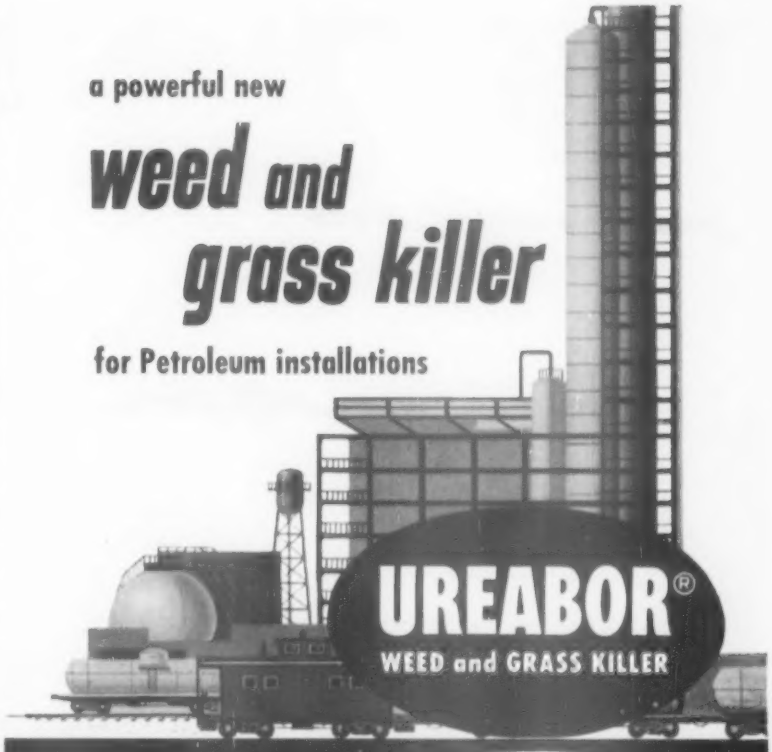

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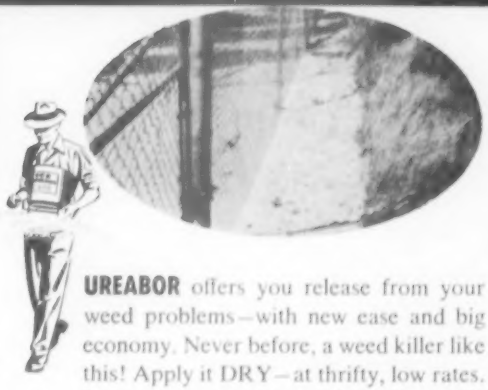

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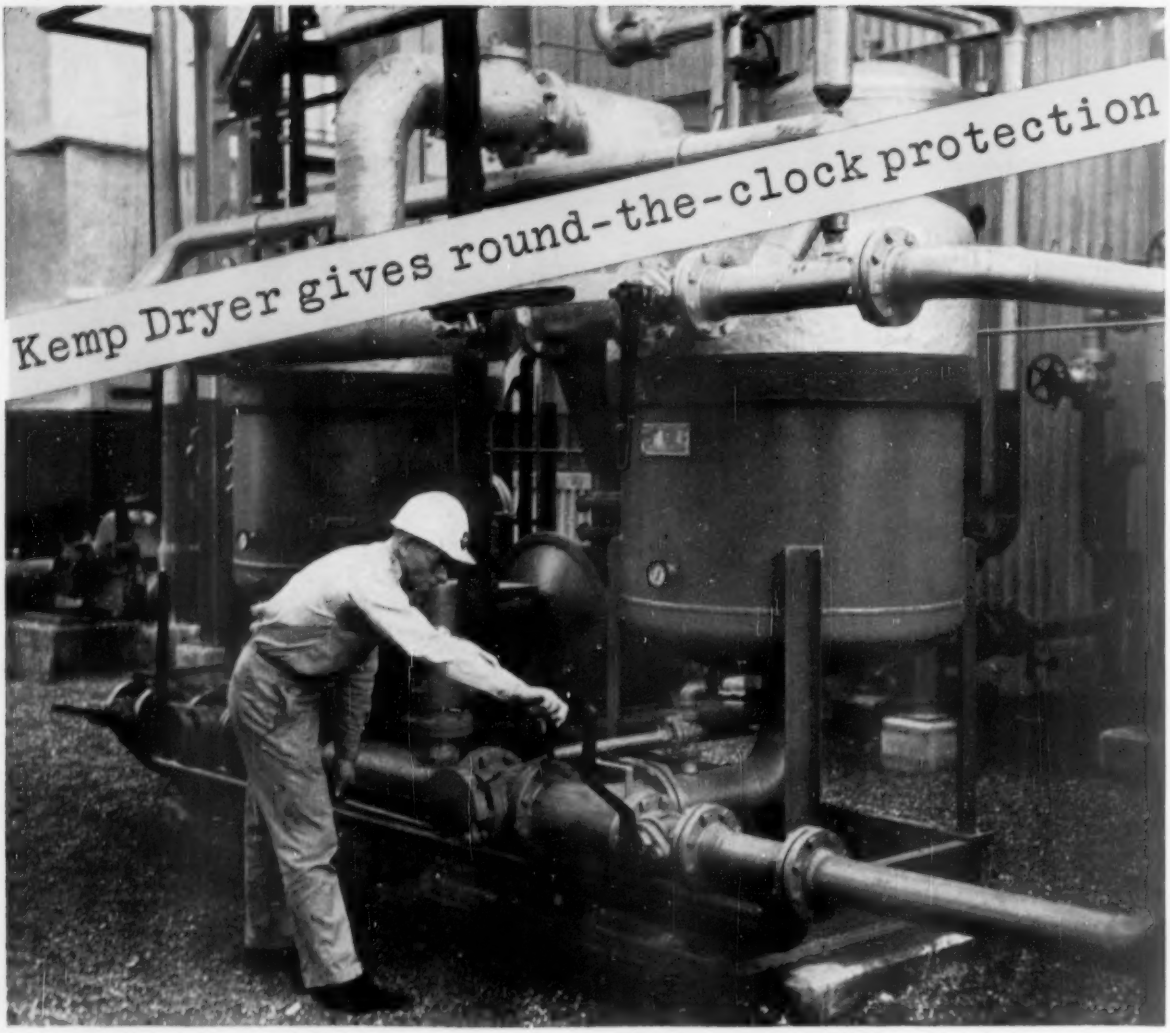

Grace Chemical Company Reports: *Kemp Dryer safeguards instruments throughout plant 24 hours per day*

The Grace Chemical Co. manufactures Anhydrous Ammonia and Urea 24 hours a day at Woodstock, Tenn. This operation demands instrument accuracy with a minimum of maintenance and downtime. To increase instrument efficiency by preventing corrosion and costly line freezes, Grace Chemical installed a Kemp Dryer.

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leum Association, committees on natural gas reserves, Banff, Alta.

17-27 Program on Recent Advances in Catalytic Polymerization, Massachusetts Institute of Technology, Cambridge, Mass.

AUGUST

2-4 Rocky Mountain Mineral Law Foundation, Second Annual Institute, University of Colorado, Boulder.

27-29 Sixteenth Annual Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.

SEPTEMBER

11-13 Pacific Coast Gas Association, annual meeting, Coronado, Calif.

13-15 Chemical Institute of Canada, third Western Regional Conference, Edmonton, Alta.

17-21 Instrument Society of America, eleventh annual international instrument-automation conference and exhibit, New Coliseum, New York City.

20-21 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Hotel Henning, Casper, Wyo.

20-21 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual membership meeting, Roosevelt Hotel, New Orleans.

24-26 American Society of Mechanical Engineers, petroleum mechanical engineering conference, annual meeting, Statler-Hilton Hotel, Dallas.

26-28 Rocky Mountain Mineral conference, American Institute of Mining, Metallurgical & Petroleum Engineers, Newhouse Hotel, Salt Lake City.

OCTOBER

2-3 Texas Mid-Continent Oil and Gas Association, thirty-seventh annual meeting, Rice Hotel, Houston.

7-9 American Association of Oil Well Drilling Contractors, annual meeting, Texas Hotel, Fort Worth.

14-17 American Institute of Mining, Metallurgical & Petroleum Engineers, Petroleum Branch, fall meeting, Biltmore Hotel, Los Angeles.

15-17 American Gas Association, annual meeting, Atlantic City, N. J.

18-19 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Rufus Garrett Hotel, El Dorado, Ark.

22-24 Rocky Mountain Oil and Gas Association, annual convention, Cosmopolitan Hotel, Denver.

29-Nov. 1 Society of Exploration Geophysicists, national convention, New Orleans.

NOVEMBER

7-8 Philadelphia section, Instrument Society of America, Symposium on Process Data Logging, Stratford Hotel, Philadelphia.

8-9 American Association of Petroleum Geologists, Society of Exploration Geophysicists, and Society of Economic Paleontologists and Mineralogists, fall meeting, Ambassador Hotel, Los Angeles.

12-15 American Petroleum Institute, annual convention, Conrad Hilton Hotel, Chicago.

19-20 American Institute of Mining, Metallurgical & Petroleum Engineers, North Texas Secondary Recovery Symposium, Municipal Auditorium, Wichita Falls.

25-30 American Society of Mechanical Engineers, Statler Hotel, New York.

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TULSA, OKLAHOMA

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JOURNALLY SPEAKING . . .

Triumph in Adversity

GRANDMOTHER used to tell us kids: "Every cloud has its silver lining." And a current best-selling author advises: "Turn every defeat into a victory."

But the veto of the Harris bill was a mighty dark cloud and a defeat of considerable magnitude. A lot of oil men haven't yet found a silver lining or figured out how, for the sake of their ulcers, to achieve any victories.

Not so with the Journal. In the photo you see Henry Ralph, the Journal's editorial writer—and author of this column when he's in town—in Washington receiving an "award for editorial achievement" from Dean Kenneth E. Olson, right, of Northwestern University's Medill School of Journalism. And it's all due to the Harris bill.

The Journal's "man with the two first names" won the honor in a contest sponsored annually by the Associated Business Publications. The entry: The collection of Journal editorials urging passage of legislation to free the independent producer from federal controls.

But let's quote Dean Olson as he presented the award:

"This was a series of very excellent editorials dealing with the federal control of natural-gas production which The Oil and Gas Journal felt would disrupt and ruin the natural-gas industry as well as reduce the supply of gas sold to interstate pipelines.

"These editorials were based on well-marshalled facts, and actually represented the best editorial writing in the competition.

"And even though the bill Mr. Ralph so ably supported was vetoed by the President after passing both houses of Congress, we want to congratuate Mr. Ralph on a very fine accomplishment, for he certainly did wake his industry to the dangers of this situation. In fact, he made a convert out of me."

We don't really believe the industry was asleep to the danger of federal regulation, but we appreciate the kind words. Regulation was — and is — a threat and the Journal was merely doing its duty in attacking the menace and in providing ammunition for the fight.

That the ammunition was used is shown by the fact that oil companies reprinted the editorials in their magazines, associations published them in their bulletins, and thousands of reprints were requested for distribution in support of the Harris bill. Journal excerpts can be found on dozens of pages of the Congressional Record.

Significantly, only three awards were made for outstanding "editorial programs"—and there are 149 business magazines and four daily business papers in the A.B.P.

Henry won't get to rest on his laurels. You'll find him back in this column and on the editorial page again next week. In between these writing stints he'll be out "checking the pulse of the industry" and doing a little research here and there for his "think pieces" and other editorial features.

—*Ted Armstrong.*

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Some good is coming from the gas veto

ONE good thing has come from the veto of the gas bill. The public's reaction shocked the whole industry into a realization of what a low opinion the country has of it.

Now there are encouraging signs that oil men are really determined to do something to improve their standing in the eyes of Congress and the public. It's beginning to soak in that poor public esteem means poor treatment by government.

The industry's future depends so much on what government—state and federal—can do to it that oil men are being scared into action. Some of the proposals of public officials to regulate—or punish—the oil and gas business make your hair stand on end.

WHY WILL PEOPLE believe almost anything bad and almost nothing good about oil men? In part it's because of some foolish antics, flamboyant actions, and brazen attitudes on the part of a few individual oil men with more dollars than sense.

While we laugh or shrug at tales of "oil-rich Texans," a myth has grown up that the whole industry is filthy rich, irresponsible, and conscienceless. The industry knows that isn't true, but has done precious little to dispel the myth.

What oil men can do is, first, anticipate public reaction to their every statement and action. They can't stop all exhibitionists from making spectacles of themselves, but they can make it known that the great bulk of the industry follows a code of conduct entitled to respect.

Actions speak louder than words, but words are needed, too. Instead of bragging so much about accomplishments, the industry should do more to explain what made these accomplishments possible. People who don't understand such things as wildcatting, gas production, percentage depletion should not be considered too hopelessly dumb to bother with.

One small example: The world's deepest well has just been completed by an independent of the type smeared in the popular press as playboys made overly rich by tax gimmicks. Now the public should be told that this well—a tremendous technical achievement and milestone of industry progress—was made possible by a typical independent's money and also his enterprise, daring, and flair for doing things in a big way.

THE SOUL SEARCHING the whole industry is now doing over its failure to be understood and liked is bound to produce good results. A new humility is apparent, and from this is springing a studied determination to live down the past and to build new confidence and approbation.

If this is followed through on the scale already started, the industry can save itself from future blows potentially more serious than the loss of this year's gas legislation.

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Current and significant in . . .

The Industry This Week

Processing

• **End to traditional two-grade gasoline marketing** may come as a result of Esso's new super premium. Another major company may convert to three grades this month. The move could revolutionize marketing, relieve pressure of octane race, give high-requirement cars needed octanes at 3 cents extra, lift ceilings on engine design. P. 80.

Turkey's first privately owned refinery is planned by an American-Turkish group. It will have 15,000-bbl. capacity, operate on foreign crude at first. P. 105.

Pipelining

• **Canadian Government** is reported ready to lend $80 million to Trans-Canada to get construction started this year on 900-mile western leg of much-discussed gas artery. P. 91.

Oil prospects in Venezuela's Apure-Barinas basin must look good. Sinclair and Socony are planning to build a $25 million big-inch crude line from the basin to the Caribbean coast. P. 105.

Industry

• **A jolt for complacent oil men** has been handed out by Frank Porter in address before I.P.A.A. at Los Angeles. He warns oil men must be their own public-relations men and defenders. Present attacks on industry have only one goal: Nationalization. P. 88.

Keep an eye on the "Francis Case" now before U. S. District Court of Northern Oklahoma in Tulsa. It may determine future of oil-payment deals in sale of producing properties. Uncertainty over tax angles reportedly has caused delay in Atlantic Refining's purchase of Houston Oil. P. 82.

Economic indicators point to bigger increases than expected in total demand, imports, and producing capacity, so say I.P.A.A. study committees. The same goes for industry costs, which increase need for crude-price increase. P. 86.

Prices on some oil country pipe products already have been upped by the steel industry in advance of basic steel hike expected in July. P. 87.

Exploration

• **White Eagle Oil Co.** has gone abroad. The firm has big concessions and new affiliates in both Cuba and the Philippines. P. 103.

Petrobras wildcat strike may open new coastal area in Brazil. Discovery well is not prolific, but it's the first show of oil and gas in the Maranhao basin. P. 103.

Production

• **A unique idea**—processing crude in the field to upgrade it—may become a reality this year in West Texas. The new idea—hydrodesulfurization—would use in part the refiners' hydrogenation technique. It would desulfurize the crude, boost gravity 7°, and increase value of this high-sulfur oil about 27 cents a barrel. P. 84.

World's deepest producer will get additional perforations just above the present pay. Flow at the record 21,443-65 ft. zone has dropped sharply. P. 91.

Microwave may expand from a pipelining tool to help production operations at the lease level. An 8-mile link in West Texas soon will carry data from automatic tank batteries into a central processing office. P. 98.

Esso's super gasoline may force a decision . . .

Will Industry Junk Two-Grade System?

George Weber

NEW YORK.—Esso Standard Oil Co. is scrapping the traditional two-grade marketing system with the addition of a third super-premium gasoline.

The Golden Esso Extra already being offered in key cities will meet the needs of hot new cars for 100-plus octane motor fuel. It will cost motorists 3 cents more than premium grade.

Esso's move could have a profound impact on marketing, refining, and auto-engine design.

This major departure from the traditional two-grade system is no experiment. Esso has already launched the full-fledged project which will put the third grade into its 18-state marketing area as fast as new pumps can be installed.

Test service stations have been converted in Boston, New York, Baltimore, Washington, Memphis, and New Orleans. By June 20 essentially all Esso stations in these six selected cities will have their third pumps. By mid-August Esso expects that three-fourths of its customers from Maine to Louisiana will be able to buy it.

Other Jersey affiliates—Humble, Carter, and Imperial in Canada—have been alerted to Esso's move and will announce their own intentions regarding the third grade.

Esso's move comes as no complete surprise to the industry. Talk of abandoning the regular-premium system has been rife since Sun Oil Co. began a multigrade marketing experiment in Florida last February. Even before that development, some independents like Leonard Refineries, Inc., had tested the super-premium market with marked success.

Esso's move comes on top of a growing industry conviction that Sun will follow through on its five-grade experiment. And it lends heavy support to the belief that the rigid two-grade gasoline system is passing out of the picture.

What did it . . . The swiftening premium octane race, abetted by Detroit's recent radical jumps in compression ratios, has placed refiners in a bind.

They cannot meet the octane requirements of all of the new 1956 models with premium-grade gasoline. So the new cars have had to back off on compression ratio or adjust spark settings. Both reduce their ultimate engine efficiencies. The future situation looks worse.

As Esso puts it, refineries are hard pressed to maintain high gallonage production of premium-grade gasoline which must be geared to satisfy a relatively small percentage of high-requirement cars. If this situation were to continue, as is strongly indicated, premium prices would have to rise to offset mounting manufacturing costs. This would in effect penalize many motorists who would have to pay for octane they can't use.

Hence the need for the third grade, Esso says. It will:

. . . **Save money** for the average premium-gasoline buyer.

. . . **Permit the high-requirement** car owner to realize full engine efficiency, which will offset the 3-cent premium he pays.

. . . **Reduce the refiner's** capital investment by better adjusting manufacturing costs to market octane demands.

. . . **Improve the over-all yield** of gasoline per barrel of crude.

. . . **Release motor manufacturers** from the need to restrict car design and engine efficiency to conform to the average quality of premium gasoline.

Actually, Esso was probably in as big a squeeze on premium octanes as anyone this year. Premium sales account for 40 per cent of Esso's total gallonage, higher than the national average. With only half as much catalytic reforming capacity as the industry average, Esso was going to find it tough to stay in the upper 98-octane bracket on premium at the high-volume demand expected this summer.

Diverting high-octane components in the smaller-volume, high-power fuel may relieve the situation.

Esso jumps the gun . . . Esso has been weighing such a move for many years. The target date was originally set for 1960. But developments came faster than expected. Not only did compression ratios and octanes rise above projected curves, but the spread between the requirements of the average car on the road and the hottest new models began to grow alarmingly in 1954.

So Esso jumped its own gun and is prepared to put out the super-premium gasoline well ahead of its schedule. Competition undoubtedly played a part, too. In view of the events since the first of the year, Esso had to move fast to be the first major to convert its full market area to the super-octane grade.

What octane? . . . The company declines to talk octane numbers on the new grade.

But it is well known that some 1956 cars have 100-octane appetites. Esso says its new grade will meet these needs. Company spokesmen stated that the new product cannot be rated on the conventional 100-octane scale.

Just how it compares with Sun's top grade, rated at about 101½ performance number, remains to be seen, but it's probably one performance number above 100. The answer will be supplied by tests on samples from the six cities. And these tests are proceeding apace in dozens of laboratories. The rating will be at least two octane numbers above current premium grades. Estimates of the added cost of two octane numbers at the top of the scale range from 0.75 to 1.5 cents a gallon.

What's in it? . . . The new grade, vended from gold-colored pumps, will have a higher content of aromatics and alkylate than Esso Extra.

No fixed content will apply. But aromatics and branched-chain paraffins represented by catalytic reformate, alkylate, and isomers will be stepped up at the expense of olefins from the thermal and catalytic components.

Esso says that aromatic content will run about 25 per cent or higher. This will give the fuel a higher B.t.u. content which, the company says, will provide an added bonus in fuel economy. Compression ratio alone, Esso says, will raise fuel economy roughly 22 per cent in going from 8.5 to 12 to 1. The combined effect of compression ratio and higher B.t.u. fuel rating can boost fuel economy 30 per cent over the same compression-ratio spread.

Whether Esso's new grade will outrate average premium in aromatics is

Esso's announcement of a third grade of gasoline hit refiners and marketers with tremendous impact. Amid the hubbub, these facts emerged:

- **Reaction over the nation is mixed, and some companies will resist the trend toward super-premium gasolines.**
- **Another major company is expected to announce a third grade this month.**
- **Availability of new pumps may be the limiting factor in the immediate spread of this new refining-marketing idea.**

not known. A 1955 spot analysis of 18 premium gasoline samples from three eastern cities by Ethyl Corp. showed aromatics ranging from 16.2 to 40.3 per cent, averaging 25 per cent. If this survey is representative and Esso plans to better the going premium on aromatics, it may be planning to blend more than 25 per cent aromatics.

To do this, Esso will presently rely on 30,800 bbl. per stream day in two catalytic reformers operating at Baton Rouge and Baltimore. The company disclosed it will build two more reformers, of the Powerforming type, at the Bayway and Everett, Mass., refineries. Esso's ratio of catalytic reforming to crude capacity is less than 5 per cent compared to the industry average of about 10.5 per cent.

For alkylate, Esso will draw on two units at Baltimore and Baton Rouge totaling 18,080 bbl. per stream day. On down the line the company plans to use everything in the book to maintain all three grades at octane levels required by their three classes of customers. This includes more reforming, more alkylation, superfractionation to isolate high-octane isomers from naphtha, and eventually isomerization of normal paraffins. The latter is under development by the affiliated Esso Research & Engineering Co.

Premium, regular outlook . . . Esso is silent on plans for octane ratings of premium and regular grades, possibly because the company has not yet decided specifically what to do.

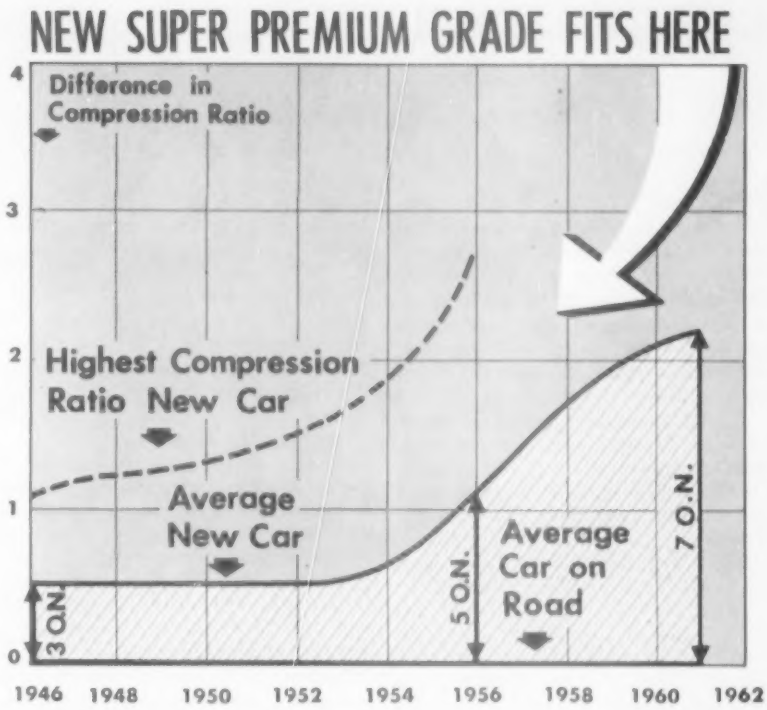
Octane quality of these two grades will be kept in line with rising requirements.

Esso regular has consistently rated in the upper limits of premium gasoline antiknock quality. It is possible that Esso may temper the premium race by holding the line for a while until the industry average catches up. If the third grade catches on in industry at large, the pressure is expected to be off premium octane. This prospect may be welcomed by some refiners who are not prepared to compete across the board on octanes.

Under a three-way system, the octane for normal premium on the Gulf Coast would tend to settle down at about 97 or 98 research. Regular gasoline, made on the Gulf Coast for East Coast use, still is expected to move to about 92 octane.

Very tight markets for aviation grades of gasoline on the Gulf Coast indicate that aviation fuel or some of its components has been routed to premium motor fuels.

Some of the important manufacturers of avgas on the Gulf Coast will become smaller sellers of the product if they follow the Esso program of marketing a super-premium automotive gasoline.



HERE'S ESSO'S ARGUMENT for a super-premium grade. New cars are rapidly pulling away from the octane requirement of the average U. S. car. They need 5 more octanes now and probably will require 7 more than the average car in 5 years. The highest-requirement cars are even further out of line with the average, leading it by about 10 numbers. Esso will fill this gap at the top of the scale with Golden Esso Extra. It will satisfy the high-compression-ratio models for a price in keeping with their high efficiency.

The 100-octane market . . . How much super premium Esso will sell remains to be seen. The company is not venturing any public guesses at present.

According to an Esso survey, one 1956 car in five is not now satisfied with average premium gasoline. This ratio is expected to rise sharply in the next few years.

Average premium grade today satisfies 95 per cent of all cars on the road but only 78 per cent of the 1956 models. Esso Extra rates roughly two research numbers above the national premium average. This would indicate that the new super-premium fuel would be needed by 15 to 20 per cent of new 1956 cars and by less than 5 per cent of all cars on the road today.

It is a safe assumption that Esso will probably sell more than 5 per cent of total gallonage this summer as Golden Esso Extra. The American motorists' yen for something new will boost gallonage beyond that absolutely demanded.

Savings to refiner, motorist . . . What if the U. S. industry adopts another grade or more?

Esso shows some enticing figures on savings. To satisfy expected requirements of new cars between now and 1961, the refining industry would have to invest three billion dollars for octane improvements alone. That's provided the two-grade system is continued. With a third grade, the investment would amount to about 1.6 billion dollars.

The motorist stands to benefit greatly. Esso says the three-grade system will save him half a billion dollars a year by 1961. He'll save this by paying more fairly for what he gets and by getting more power out of what he buys.

What will Detroit's reaction be? Obviously automotive manufacturers are not saying yet how their future plans might be affected. But if the industry takes on one or more super-premium grades for nation-wide distribution, the compression-ratio ceiling now imposed by premium octanes would be lifted significantly.

Detroit, involved in a stiff competitive situation, will presumably be quick to realize the advantages of introducing some higher compression-ratio models.

The over-all result might be a greater spread between the lowest and the highest compression ratios of future models conforming to wider selection of octanes from more than two gasoline grades.

Houston Sale Delayed

Atlantic Refining holds up purchase awaiting tax ruling; future position of oil-payment deals at stake in court

UNCERTAINTY over federal tax rulings has caused a delay in closing the $224,654,265 deal in which Atlantic Refining Co. was to buy Houston Oil Co. and Houston Pipe Line Co.

The sale, largest ever proposed involving oil payments, was approved last week by stockholders of the Houston company.

But Henderson Supplee, Jr., president of Atlantic, later informed his stockholders that Atlantic will withhold final closing until tax rulings are made by the Commissioner of Internal Revenue.

Supplee indicated the tax matters might not be worked out satisfactorily until fall.

The deal as announced in January calls for an intermediate company, Nalam Corp., of New York, to buy Houston's oil and gas properties. Atlantic would take over the operation and eventually acquire ownership through oil-production payments *(The Oil and Gas Journal, January 16, page 72)*.

The Francis case . . . One of the tax matters snarling the Houston-Atlantic sale is understood also to be an issue in the famous "Francis Case" now nearing a decision in U. S. District Court of Northern Oklahoma.

The future tax positions of oil payments in the purchase and sale of producing properties is believed at stake in the case which first was filed a year ago.

Oil attorneys over the nation are keeping a close watch on its outcome. They say that cases involving oil payments vary widely as to facts and tax positions. But they believe that the ruling of the Internal Revenue Service now being challenged by Francis Oil & Gas Co., Inc., if sustained by the courts, will hold general significance in deals which involve oil payments.

What's involved . . . The Francis company, independent producing firm with headquarters in Tulsa, in 1948 purchased from Barclay Oil Co. an undivided one-half interest in producing oil and gas leases located in Kansas.

The purchase priice was $165,000 cash with additional oil payments of $375,000 payable out of 95 per cent of oil and gas produced from the one-half interest.

The Francis firm deducted from its gross income as expense all of its expenditures covering intangible drilling and development costs including those of the former Barclay properties. Under the 95 per cent oil-payment plan, the Internal Revenue Service held that $51,402.50 of the 1949 gross income and $23,466 of the 1950 income could not be charged as intangible cost of development and should have been capitalized.

The Government held that the Francis company was not entitled to deduct from gross income the amounts which should have been capitalized. This holding substantially increased the tax liability of the company for the 2-year period including an excess-profits tax. The higher tax assessment was paid by the Francis company.

Since then there has been a small refund to the Francis company, but the principal contention involving the main deductions at issue in the 95 per cent oil-payment program were not allowed by the Government. This resulted in the filing of the district court case a year ago by the Francis company. The company is seeking a refund of $15,468.26 for taxes paid in 1949 and 1950.

The Internal Revenue Service's position in effect is that the buyer in this case is not entitled to intangible and development costs applying to that part of the properties covered by unpaid oil payments.

In general there has been tax advantage to the buyer who uses oil payments to cover part of the purchase over situations in which all-cash deals are made covering the entire selling price.

The question now being raised is concerned with how far the oil-payment tax advantage applies in deals also involving drilling and other operational costs transferred with the producing property. This is the principal issue to be decided in the Francis case.

The tax payments accruing under oil payments for many years were of minor importance with some long-range offsetting advantages accruing to the Internal Revenue Service. But the increasing use of oil payments, including major transactions involving millions of dollars, has become a matter of concern to income-tax officials at Washington. Special studies have been made by the Internal Revenue Service.

Another similar transaction of the past year was the sale of American Republics Corp. to Sinclair Oil & Gas Co. The sale price was $108,000,000 with $75,000,000 to be paid by a group of bankers through oil payments.

Hawn case . . . Because of the growing interest in income-tax policies involved, some observers feel that the recent Hawn decision of the United States Court of Appeals for the Fifth Circuit at New Orleans has a bearing on the tax position of oil payments.

The court found for the Government and reversed the finding of the Tax Court of the United States.

In this case John David Hawn owned an oil-payment right of $888,993.25 in certain oil properties located in Refugio County, Texas. Hawn made an agreement under a transfer arrangement with a third party to build a house to cost a maximum of $120,000 to be paid for out of the oil payments. When the $120,000 was paid, the remaining payments were returned to Hawn.

The question raised in this case was whether the $120,000 was to be treated as capital gain to Hawn with the oil payment received by the contractor being reportable by him as gross income, subject to the normal percentage depletion in his hands. The Tax Court, with six judges dissenting, held in favor of Hawn. The Circuit Court reversed this decision holding that the transaction was not a sale of capital assets but was a transfer of $120,000 of the taxpayer's income.

Gas Men Lose Again

Fair field price denied as basis for rate hike

WASHINGTON.—Fair field price as the basis for rate increases by independent gas producers was ruled out last week by the Federal Power Commission.

An FPC examiner held that four independent producers in Louisiana had not justified rate increases totaling $2,635,900 a year for gas sold the Transcontinental Gas Pipe Line Corp. The producers are Union Oil Co. of California, Louisiana Land & Explorationn Co., Morris Rauth et al., and Beloil Corp.

The examiner said the producers based their case originally on the fact their contracts were made by "arm's-length bargaining." The commission, he said, has made it clear that while such evidence deserves consideration it is not sufficient alone to sustain the producers' burden of proof.

At a recent hearing, the producers offered only "material designed to persuade the commission that, in the absence of proof of collusion or bad faith, just and reasonable rates for

the producers - applicants should be fixed on the basis of unregulated field prices for comparable gas."

The examiner explained that his decision denying the increases does not rest only upon any claimed deficiency in the particular type of field-price evidence presented. It also rests upon the belief that field-price evidence alone is in no event sufficient to sustain a proposed rate increase.

The examiner added if the financial interest and needs of the producer are not considered the Natural Gas Act becomes ineffective. He said it then becomes "merely a vehicle for approving and rubber-stamping all new contract prices arrived at without collusion, so long as they do not exceed levels already reached."

Gas Precedent Set

Producers forced to show price hike is reasonable

WASHINGTON.—A little gas case made big news here last week. Difficulties of small producers in breaking the "freeze" of gas prices caused by Federal Power Commission regulation are illustrated by the case of eight Wyoming producers selling gas to Montana-Dakota Utilities Co. from South Elk Basin and West Graybull fields.

An FPC examiner has recommended denial of the increased price applied for because the producers failed to come to Washington and prove that the increase is reasonable. Instead of showing up at the hearing, several of the producers wrote FPC that the amount of money involved in the increase would not cover the expense of sending attorneys and expert witnesses.

Continental Oil Co., the biggest producer involved, withdrew its application with the explanation that it had not been allowed enough time to prepare the matter so that FPC could have a full understanding of the issues and facts involved. Other producers in the case are Knox Oil Co., Wyopark Oil Co., Oxford Oil Co., Fred M. Manning, Fred Goodstein, and Estate of F. E. Brown.

Unless the companies appeal within 30 days—which seems unlikely—the examiner's decision will stand.

The importance of this relatively minor case is that, since it is among the first FPC actions in denying a producer's price increase, it becomes a precedent for building an FPC policy of requiring all producers to bear the burden of proof and to make a full showing that a price increase is not unjust or unreasonable.

watching WASHINGTON

... with Bertram F. Linz

Bankers or oil men—that is the question . . .

A NUMBER of companies which own banks, oil operations, and varied other activities are going to have to decide whether they want to be bankers or industrialists.

A new law was sent to the White House last week by Congress. It makes any company owning a 25 per cent interest in two or more banks a bankholding company. It may not engage in any other operations.

While debate on the law didn't disclose what companies hold oil interests as well as banks, it is known there are a considerable number. They will be given 2 years in which to dispose either of their banks or their other interests.

A good example of the type of operations which Congress seeks to regulate is W. R. Grace & Co. Grace has shipping, chemical, mercantile, insurance, and other interests as well as a New York bank, and has just taken over Cosden Petroleum Corp. *(The Oil and Gas Journal, April 30, page 83).*

Grace was saved at the last minute by the refusal of the Senate to extend the bill to companies which own even one bank. But companies with interests in two or more banks will not be so fortunate.

WOC's get Democratic punch in the nose . . .

WEEKS' WOC's were whacked last week. A WOC is a businessman serving the Government without pay. The job used to be worth $1 a year but the salary was cut because checks went into frames oftener than banks and messed up the government's bookkeeping. They can be employed by a number of departments, but the greatest number are in Commerce.

A Democratic majority of the House antitrust subcommittee charged that oil men and other industrialists serving the Commerce Department were allowed by Secretary Sinclair Weeks to act as "company ambassadors plenipotentiary to the Government on their company's government business."

"Unfair," yelled the Republicans in a minority report. WOC's were of "inestimable value in attaining an adequate mobilization posture." Continued attacks on highly placed industry experts willing to serve the Government when needed might leave the country in a hole in another emergency, they warned.

Control of world prices laid at Texas' door . . .

THERE may be new talk in Congress about the "oil cartel" before the end of the session.

The way for discussion was opened by Sen. Wayne Morse of Oregon. He recently used 31 pages of the Congressional Record to carry an attack on the administration's foreign policy written by James P. Warburg, New York financier.

Oil got considerable space in Warburg's thesis. The world price of oil, he charged, is fixed largely by the State of Texas.

Government influence has been exerted in favor of the producers, Warburg charged. But there has been no action to protect the consumer's interests. Prices must be brought into some sort of relation to costs, he contended. If the Government doesn't do it, the nations of western Europe may force action, he believes.

"Oil may be a touchy subject in Washington these days, but the fact remains that our present policy of subservience to the international oil cartel casts doubt upon the sincerity of our professed belief in free competition as well as upon the sincerity of our Atlantic Charter promise of equal access to the raw materials for all of the world's peoples," Warburg concluded.

New use of a new idea promises . . .

Sweet Crude From Sour-Crude Fields

. . . And a higher gravity to boot

Robert J. Enright

DALLAS.—One of the most revolutionary developments in crude-oil production history may materialize soon in Howard County in West Central Texas.

Chances are good that within a year, a new type of field installation there will be making sweet higher-gravity crude oil from low-gravity, extremely sour oil, which is currently a distress commodity on the West Texas market.

Independent producers in this area have been able to market only a portion of their allowable production of sour oil in recent months.

One of these independent operators, Daniel W. Varel, of Dallas, has been actively investigating the possibility of building a plant to beneficiate the oil for several months.

First Development Corp., Dallas, headed by J. B. Allinson, has been retained as general consultant to do the actual investigating work.

Last week, Varel, a prominent manufacturer of rock-type drill bits, who also operates drilling rigs for his own account and has substantial production in West Texas, told the Journal that preliminary pilot-plant runs on samples of the sour oil from Varel field in Howard County have been completed and "results have been very favorable."

Further tests will be run on the crude and final cost figures assembled, Varel said, before a final decision to build a treating plant is made.

Varel pointed out that treating crude to remove sulfur and other objectionable contaminants in the field is just carrying conventional treatments, such as stabilization and dehydration, a step further. It would be, he contends, a highly logical step if tests show it to be economically feasible.

Varel declined to say what method or whose process would be employed to sweeten the crude—which contains about 2½ per cent sulfur and runs about 29° gravity.

Hydrodesulfurization possible . . . It is virtually certain, however, that one of the best-known catalytic hydrogen-treating processes will be used.

Such an operation would require an outside supply of hydrogen—possibly amounting to 500 cu. ft. or more per barrel of crude desulfurized. The operator could acquire a hydrogen supply in one of two ways:

NEW PLANT is expected to be built near Varel field on the T.P.&R. Railway. It would require a new pipeline gathering system.

. . . He could build an auxiliary unit to produce hydrogen. This most likely would be a gas reforming unit or a synthesis gas generator. Either type would hike the treating cost considerably.

. . . He could buy hydrogen from someone who manufactures it in the vicinity. There aren't many makers of hydrogen in the area with surplus product. However, Cosden Petroleum Corp., a large independent refiner at nearby Big Spring, Tex., in the same county, told the Journal it had surplus hydrogen amounting to roughly 6,000,000 cu. ft. which now is being used as plant fuel.

What it would do . . . If hydrogen treating should be used, the treating benefit wouldn't end with merely desulfurizing the crude (sulfur content would be cut from 2½ per cent in the Varel-Moore field area crude to a fraction of a per cent). Other benefits would include:

. . . Higher gravity. Gravity of the treated oil would run about 7° higher, or about 36°. Such sweet oil is now quoted at $2.82 a barrel—making a differential from the raw state of about 27 cents a barrel.

. . . More crude. Volume of the crude would be boosted roughly 2 per cent by adding hydrogen over the original crude volume.

. . . Fewer contaminants. The treatment also would remove nitrogen, oxygen, and contaminating metals such as vanadium. All of these elements are undesirable crude ingredients.

Cost an important factor . . . Varel told the Journal that the project is not sufficiently advanced to fix construction and operating costs.

It is believed that the projected plant would most likely have a charge capacity of about 10,000 bbl. a day, with 5,000 bbl. a day a probable minimum figure.

It is understood that a "light touch" of hydrogenation, enough to convert most of the complex hydrocarbon-sulfur compounds to removable hydrogen sulfide, has been proved feasible in pilot-plant studies.

The only data on hydrogen treating of whole crudes so far were reported last year by Gulf Research & Development Co., employing its HDS process. It has been established by the Journal, however, that Gulf is not the firm which ran the pilot-plant tests on the Varel crude.

The HDS version of hydrogen treating is aimed at partial conversion or hydrocracking of the crude, in addition to straight desulfurization. Costs here probably would run substantially higher than in a simpler process designed primarily to remove sulfur.

HDS pilot-plant runs on a whole sour West Texas crude show that:

. . . Sulfur content was reduced from 1.48 to 0.22 weight per cent.

. . . A.P.I. gravity of the whole crude was hiked from 34.4° to 43.4°.

. . . Bottoms fraction (670° F. and heavier) was reduced from 40.7 to 15.9 per cent of total crude.

. . . Distillate yields were boosted correspondingly, about 10 per cent on gasoline, 4 per cent on naphtha, and 9 per cent on furnace oils.

. . . Octane rating of the 300° F. end-point straightrun-gasoline fraction was improved by about seven numbers by the A.S.T.M. motor method.

. . . Burning qualities of the furnace oil were improved.

. . . Color and odor of diesel fuel cut were improved and cetane number increased.

It has been estimated that use of this process to treat whole West Texas sour

Here's the Man Behind the New Idea

DAN VAREL, the man behind what may be one of the most exciting oil-production developments in recent years, has the wildcatter's instinct. He'll take a big risk or tackle a tough problem. But his risks are calculated and his instincts are tempered by a sharp business sense.

Varel is a mechanical engineer (University of Detroit) and former assistant to the president of the old Packard Motor Co., where he spent 12 years. For 2 years, he was president and general manager of Engineering Laboratories, Inc., of Tulsa and Dallas.

In 1947, he founded Varel Manufacturing Co., and since then has launched three more firms, Garland Heat Treating Co., International Bit Co., and Canadian Oil Tools, Inc. He is president of all four.

As an independent oil operator, he has developed substantial production in Howard, Stephens, and Scurry counties of West Texas. A little over a year ago he drilled the discovery well in the field which bears his name.

The youthful Varel (he's 43) doesn't take himself too seriously, despite his imposing list of accomplishments. A keen sense of humor makes him popular with those who work with him and for him.

DAN VAREL

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crude would require an investment (for a 20,000-bbl. unit) of about $500 per barrel of daily capacity, a direct operating cost of 25 cents a barrel, and a total operating cost of 50 cents a barrel (including 10 per cent depreciation and all fixed charges).

While these improvements in product yield and quality might attract commercial interest in the HDS processing of West Texas crude by a refiner, it is less probable that a producer would be able to realize a sufficient price bonus for his improved crude to justify a field installation of this process.

It is apparent that Varel is aiming at a milder form of hydrodesulfurization which will knock down sulfur as a matter of first importance. Other changes in the crude, though all are desirable, would be of secondary importance.

The simpler operation would cost considerably less for both construction and operation. A field unit, for instance, would not have to run 30 or 31 days a month, as would such a unit in a refinery. Construction and operation corners could be cut.

The fact remains, however, that even at the lower level of treating believed contemplated by Varel, the treated crude should command some premium. A 36°-gravity sweet oil containing for all practical purposes no sulfur, nitrogen, oxygen, or contaminating metals should be worth more to a crude buyer than the $2.82 a barrel posted for crude of that gravity in the area.

Varel may well be counting on these added improvements in crude characteristics to bring a premium price for the crude and help offset the high cost of such crude treatment.

Relief needed . . . As is the case in many oil-industry developments, the revolutionary treating plant, if it materializes, will come because of a pressing need.

Independent producers in the general area of Howard, Mitchell, Scurry, Glasscock, and Sterling counties are hurting in that they have been pipeline prorated in some cases down to the point where they can sell only half or less of their allowable production of sour crude.

Fracturing of shallow pays like the Clearfork and San Andres has swelled oil production so much that it has swamped traditional markets for the oil from these fields *(The Oil and Gas Journal, March 12, page 80; March 26, page 70; and April 9, page 70).*

The traditional markets are primarily local refineries operated at Big Spring and Colorado City, Tex., respectively, by Cosden Petroleum and Col-Tex Refining Co. Larger buyers take small volumes by truck and pipeline.

Surplus sour oil without a market in the area recently was estimated by the Journal to have soared well above 10,000 bbl. daily.

Hydrogen treating, a comer . . . Meanwhile, refiner interest in hydrogen treating of not only reduced, but whole crudes as well, is soaring.

Surveys by several large companies are revealing attractive economics.

It is understood that a major oil company is considering hydrodesulfurization of whole crude in a large East Coast refinery.

Another large operator may install a hydrogen treater in a foreign refinery.

Still others are known to be investigating along this line, and it now appears that construction of a number of such units may not be far off.

Shut-In Extended

Greater Clareton order is continued to December

CHEYENNE. — The Wyoming Oil and Gas Conservation Commission has extended its order shutting in excessive gas producers in Greater Clareton field until December 1.

The original order, issued last June and extended once before, applied to 167 wells producing more than 5,000 cu. ft. of gas per barrel of oil in the 608-well field.

The only exception allowed was a hardship case of Mountain Valley Gas Co., which has been processing 2,500,000 cu. ft. of gas daily.

The commission's latest order followed receipt of a letter from Core Laboratories, Inc., Dallas. Core estimated the shutdown saved more than 9 billion cubic feet of gas from June 1955 until April and nearly 600,000 bbl. of recoverable liquids.

Core endorsed reinjection of residue gas into the producing formation as is being done by Mountain Valley and Wynton Oil & Gas Co. plants.

Wynton has bought out two partners in Tri-Co Gas Co., which has been testing a new Clareton cycling plant. Wynton acquired the interests held by Rosebud Oils, Inc., and Voss Oil Co.

The company proposes to build a second extraction plant in Weston County to process 7,000,000 to 10,000,000 cu. ft. of gas daily. It would be located about 7 miles north of the present Tri-Co plant in the Black Thunder region south of Newcastle. Contract is to be let soon with completion due by October. A third plant will be constructed if developments warrant, Wynton said.

Life of the 35,000,000-bbl. field has been estimated at only 6 to 18 months unless pressure-maintenance is practiced.

Oil Indicators Point Up

I.P.A.A. special committees report demand, imports, and producing capacity all on rise; big need is a price hike

LOS ANGELES.—Study committees of the Independent Petroleum Association of America at the semiannual meeting held here last week forecast:

. . . **Total oil demand** this year will average 9,197,000 bbl. daily, 4.7 per cent higher than in 1955.

. . . **Imports** will account for an average of 1,440,000 bbl. daily, up 15.4 per cent, of the required 9,235,000 bbl. daily of new supply required to meet this demand and add to inventories.

. . . **Producing capacity** of the domestic petroleum industry will rise more than a half-million barrels by next January, to the record level of 10,280,000 bbl. daily.

In addition an I.P.A.A. cost-study committee pointed out a great need now is an increase in prices of crude oil. The group declared that crude prices have remained unchanged for 3 years. But during this period the cost of finding and developing a barrel of oil has increased more than 20 per cent.

The supply-demand committee's estimate of a 9,197,000 bbl. domestic and export demand is 200,000 bbl. higher than its estimate last October. This increase is credited to colder than normal weather during the early months of 1956 and an improved outlook for general business activity through the remainder of the year.

Demand for the six warm months, April to September, is expected to average 8,620,000 bbl. daily, or 4.9 per cent greater than the same period last year. From October through March 1957, the committee estimated total demand at 9,958,000 bbl. daily, 3.7 per cent higher.

Commenting on this seasonal fluctuation in demand, the committee said that changes in inventories cannot absorb the full impact. It declared that adjustments in crude-oil supply and refinery operations immediately following the heating-oil season are needed more than ever now.

Productive capacity . . . The I.P.A.A. committee on productive capacity forecast the U. S. would be able to produce more than 10,000,000 bbl. daily by January 1957.

The group reported that U. S. capacity increased 534,000 bbl. daily in 1955 and will rise a half-million barrels more by January 1957. Crude capacity as of January 1956 was 8,929,000 bbl. daily. It is expected to rise to 10,280,000 bbl. daily early next year.

But the petroleum industry last January was using only 82 per cent of its production capacity. This meant an idle capacity of 1,753,000 bbl. or 18 per cent.

Costs up, up, up . . . The cost of finding and developing a barrel of oil has risen so fast and prices have lagged so far behind that the oil industry is strapped to meet increased expenditures.

The cost-study committee pointed out also that between the last oil price raise in June 1953 and the end of 1955 hourly wages in the oil-producing industry increased 7.4 per cent, construction costs 11.8 per cent, wholesale finished steel prices 13.3 per cent, and structural steel 17.9 per cent.

It added that in the last few months, hourly wages in oil production have increased 9 to 10 per cent. Steel costs increased recently because of limited supplies and an approximate 7 per cent increase in freight rates. A substantial basic steel price increase is expected around July 1.

Increases also were experienced in cost of services such as perforating, drill-stem tests, and other similar jobs. New methods of completing wells also have added to costs. At the same time, lease bonuses, lease rentals, and services costs have gone up.

The committee said more funds are needed to maintain a normal ratio of reserves in relation to amount of oil withdrawn. The present ratio of reserves is 12.9 times annual production compared with 14.7 in the 5-year period preceding World War II. It would require finding nearly 5 billion barrels of additional reserves to bring the present ratio to its prewar level.

Dangers ahead . . . Directors of the I.P.A.A. in a policy statement warned the oil industry is being liquidated.

The board said the sale of oil and gas does not provide the producing industry with sufficient funds to discover and develop new reserves. Oil and gas,

I.P.A.A.'s Supply and Demand Forecast

	1956					1957
	First quarter*	Second quarter	Third quarter	Fourth quarter	Year	First quarter
Total Demand	**9,745**	**8,635**	**8,605**	**9,800**	**9,197**	**10,115**
Gasoline	3,480	4,095	4,100	3,875	3,888	3,635
Kerosine	480	175	210	455	330	480
Distillate	2,465	1,285	1,200	2,135	1,771	2,575
Residual	1,875	1,495	1,380	1,745	1,623	1,890
Other	1,445	1,585	1,715	1,590	1,585	1,535
Exports	**315**	**340**	**335**	**320**	**328**	**300**
Gasoline	85	90	90	85	88	80
Kerosine	10	10	10	10	10	10
Distillate	55	65	65	60	61	50
Residual	75	75	70	65	71	70
Other products	65	70	70	70	69	65
Crude	25	30	30	30	29	25
Domestic Demand	**9,430**	**8,295**	**8,270**	**9,480**	**8,869**	**9,815**
Stock Change	**—301**	**+555**	**+337**	**—435**	**+38**	**—366**
Total New Supply	**9,444**	**9,190**	**8,942**	**9,365**	**9,235**	**9,760**
Total Production	**8,004**	**7,800**	**7,552**	**7,825**	**7,795**	**8,175**
Crude	7,196	7,072	6,806	6,997	7,017	7,347
N.G.L.	808	728	746	828	778	828
Total Imports	**1,440**	**1,390**	**1,390**	**1,540**	**1,440**	**1,585**
Crude	850	930	965	975	930	985
Products	590	460	425	565	510	600
Closing Stocks (million bbl.)	**687.5**	**738.0**	**769.0**	**729.0**	**729.0**	**697.0**
Gasoline	198.0	170.0	155.0	168.0	168.0	200.0
Kerosine	17.5	30.0	36.5	27.5	27.5	18.0
Distillate	62.5	97.0	145.0	117.0	117.0	65.0
Residual	34.0	38.5	42.5	39.5	39.5	35.0
Other products and natural gasoline	110.5	117.5	115.0	109.0	109.0	113.0
Crude	265.0	285.0	275.0	268.0	268.0	266.0
Runs to Stills	**7,963**	**7,697**	**7,795**	**7,953**	**7,852**	**8,264**

*Estimate based on Bureau of Mines and A.P.I. figures.

COST STUDY Committee of the I.P.A.A. is shown in session during the Los Angeles meeting. Members from left to right are C. A. Pfahler, Sun Oil Co., Philadelphia; L. J. O'Connor, Jr., Goldston Oil Corp., Houston; M. L. Mesnard of the I.P.A.A. staff, Washington; J. V. Brown of National Petroleum Association, Washington, committee chairman; Stark Fox, Oil Producers Agency of California, Los Angeles; P. R. Schultz, Blackwell Oil & Gas Co., Tulsa; and J. P. Coleman, Wichita Falls, Tex., producer.

it pointed out, are being sold at less than its replacement costs and added:

"Any industry that does not have the funds to cover replacement costs is in the process of liquidation."

Directors also declared that crude prices have not changed in 3 years and have only increased slightly in the last 8 years. In addition, imports have continued to take a large share of the U. S. market and the industry's ability is being further hampered by unsound and unjustified federal control over the production of natural gas.

Prices Increased on Some Pipe Products

PITTSBURGH. — The steel industry has increased prices on selective oil country pipe products from 2½ to 12 per cent in advance of the basic steel hike due in July.

The National Tube Division of United States Steel Corp. led off the increase and other majors, such as Jones & Laughlin Steel Corp. and Bethlehem Steel Co., quickly followed suit.

National Tube said the increases reflected higher manufacturing costs and were in the nature of "price corrections," averaging 3 per cent. They provide a tonnage incentive for mills turning out the tight small-diameter tubular goods on which labor costs per ton are much higher. A big tonnage item, large-diameter pipe from 14-36 in., also was increased 3 per cent.

The change had nothing to do with pending negotiations with union steelworkers whose contract expires July 1. The new labor contract, plus industry pressure to raise prices to obtain expansion capital, are expected to result in a basic steel increase of $8 to $15 per ton compared with last year's $7.35.

These higher prices, plus increased labor costs at the mills, will be reflected in new increases for the steel products which the oil industry buys. Industry consumption last year was around 5½ million tons.

Here is a breakdown of the selective price hike:

Casing—5-in. o.d. up 5 per cent, 6-in. and larger no change.

Tubing—2⅜-in. up 2½ per cent, larger sizes no change.

Drill pipe—2⅜-in. o.d. up 12 per cent, 2⅞-in. up 10 per cent, 3½-in. up 7½ per cent, 4-in. up 6 per cent, 4½-in. up 5 per cent, 5-in. up 5.3 per cent. No change on larger sizes.

Byrd Interests Are Sold

DALLAS. — Controlling interest in Byrd Oil Corp. has been sold by Col. D. Harold Byrd, founder, for an undisclosed sum.

Purchasers are Alan M. Abernethy, Toronto, Ont., financier, and Sen. James J. Crisona, New York. Abernethy has been elected president and Crisona a director. The latter is also president of Bristol Oils, Ltd., an Ontario firm with interests in more than 300 producing wells in the United States.

Byrd said identity of the firm will be retained under the purchase agreement. He will remain as chairman of the board. A. Harvey Arant, Dallas, has been named vice president.

Byrd Oil Corp. properties include 120 producing wells in Texas, New Mexico, and Louisiana, plus 97,000 acres of undeveloped oil and gas leases and numerous mineral claims in these states and the Four Corners area.

Byrd was one of the first operators in East Texas field. He has been in the oil business 39 years.

Premium Drops

First decline in 3 years shows up in Ethyl survey

NEW YORK. — The first decline in premium gasoline octanes in nearly 3 years took place in April as the weighted average research number declined to 96.3 from the record highs of 96.4 recorded in February and March.

Ethyl Corp.'s monthly survey also showed regular grade unchanged from March, at 89.3 research octane.

The April dip reflected some backing-off at higher premium octanes, with 15 cities averaging 97 octane or over. This compares with 18 cities in that category in March. Several cities also showed declines in top octane averages in regular grade. Of the 53 cities and marketing centers in which Ethyl analyzed 850 samples, 15 showed increased premium octanes over March, 28 averaged lower, and 10 were unchanged. On regular, 20 cities averaged higher than March, 26 averaged lower, and 7 showed no change.

A breakdown of cities in the various octane levels follows:

PREMIUM

	April 1956	Mar. 1956	April 1955
90-90.9	0	0	2
91-91.9	1	0	1
92-92.9	1	2	5
93-93.9	2	5	9
94-94.9	8	5	12
95-95.9	12	13	8
96-96.9	14	10	16
97-97.9	15	18	0
Total cities	53	53	53
Wtd. avg. RON	96.3	96.4	95.2
Wtd. avg. TEL, ml./gal.	2.51	2.47	2.52

REGULAR

81-81.9	1	0	0
82-82.9	0	1	2
83-83.9	1	0	2
84-84.9	0	1	5
85-85.9	1	3	11
86-86.9	18	15	8
87-87.9	1	2	11
88-88.9	7	4	0
89-89.9	9	12	7
90-90.9	4	5	7
91-91.9	11	9	0
92-92.9	0	1	0
Total cities	53	53	53
Wtd. avg. RON	89.3	89.3	87.7
Wtd. avg. TEL, ml./gal.	2.26	2.22	2.12

"There Is a Time to Keep Silence" . . . But . . .

Oil Men Now Must Speak or Surrender

Once in a while a truly outstanding speech is made. The Journal believes this is one. It was delivered by Frank Porter, A.P.I. president, before the I.P.A.A. last week in Los Angeles.

Deletions were made for space reasons, but here, in his own words, are Porter's view of the industry's most pressing problem and his ideas on what must be done to solve it. It's recommended reading.

CIRCUMSTANCES decided my subject. It is a subject as unavoidable as it is unpleasant. It is the industry's foremost problem today.

This industry of ours is being subjected to one of the worst bombardments of abuse ever endured by an American enterprise. We are being hit with everything they can throw at us, and, as he takes this pounding every oil man must have asked himself—Why? What really provoked this frenzy of criticism? . . .

Outstanding achievement has made us conspicuous. Just as a steeple rising high on the landscape attracts lightning, the oil industry attracts the wrath of those who resent success—most especially the success of the American free enterprise system.

Isn't there a parallel in the attitude toward our own country abroad? With almost boundless generosity, our Government has poured out billions upon billions of dollars to aid people in every part of the globe . . . Yet it seems the more we give away the more we are condemned.

Overseas we know where these charges originate. They are in large part inspired by the Communists who infest every land. Over here those of Communist or Socialist or other left-wing persuasion mastermind the attack against our industry.

For recruits and reinforcements the leftwingers draw on those who have somehow, somewhere along the way, lost faith in American ideals. These people are not Communists. They would be the first to tell you that they abhor Communism. But whatever sentiments they may consciously proclaim, subconsciously they have embraced Communist theory. . .

Even after seeing every day all that competitive enterprise has done and can do in this country, these people tell themselves that the system won't work any more—that it has to be controlled by Government.

There are fashions in political thinking as rigid as ever prevailed in women's styles. Many people would be as much afraid of thinking an unfashionable thought as of going to the beach in a 1920 bathing suit. And it is our misfortune that today the most copied style-setters of American political thinking are people of leftward leanings.

1. The Problem

This is American enterprise as it stands before us today: It is a giant of initiative and strength. Its mind is keen. Its vision clear. It has just one physical defect: It's tongue-tied. Though our critics and detractors can't match us any where else, this one thing they can do: Talk rings around us.

This is the oil industry's problem. It is the problem of American free enterprise as a whole—of every industry and of all industries. But because denouncing our industry has become high fashion at the moment, this problem is now preeminently ours.

Years ago Kin Hubbard wrote: "The feller that sets on a store box with his mouth full of scrap terbacker while his wife is at home sewin' for a livin' knows jist exactly how t' regulate the railroads."

Well, the modern counterpart of this fellow is full of ideas about regulating the petroleum industry.

He warms to the thought, cleverly planted in his mind by leftwing agitators, that his troubles do not spring from any fault of his own, not from his ineptitude, and apathy, but from a social system that he thinks is stacked against him. Refusing to climb the rungs of the ladder of success by his own effort, he denounces society for failing to provide him with an elevator. He is a bitter man.

What are the chances of winning this man over to our side? Not very good.

But we wouldn't have to worry about his negative influence if it weren't for this fact: The general atmosphere of the time projects his fantasy like a mirage on the horizon. Change the atmosphere and the mirage will vanish.

We have a hard, hard job ahead of us in getting the straight story across, especially to people in the states that have no oil production.

When a man swallows poison, he can be treated with a stomach pump, but when he has taken a poisonous idea into his brain, there is no way to pump it out. He must be treated with the slow-working antidote of education. And that's what we in the oil industry have to do—a job of education. I'm not talking about this as a job for only one group of specialists—the public relations people. It's a job for every oil man.

Surely no one in our industry suffers the delusion that public relations is mainly a concern of the industry branch that deals directly with the public—the marketing branch. What people think of the industry in all its branches is very much a concern of every branch.

What people in New England think about Texas oil procedure may, in the end, be a decisive factor in the fate of percentage depletion. That's the rea-

son why the current crop of jokes about free-spending Texas oil men are not very funny to folks in our industry. They are creating a myth that it will take a powerful dose of facts to dispel.

2. The Job Ahead

In recent years this industry has waged a rigorous and, I believe, highly effective public relations campaign of that kind. We were moving ahead. We were gaining ground. But events of the last few months have thrown us for a loss. Now it will be a tough struggle to get back to where we were last January—even though the goal is much farther on. We must regain lost friends besides making new ones. We must repair our lines of communication with the public. . .

In carrying out our program, we must make sure never to supply our critics with any of the ingredients for more of their poisonous potions. I mean by this: Every man—every member of every segment of this business—must take it upon himself to behave in such a manner that no act nor word of his can be used to damage his industry. This is a big order. It is an almost overpowering responsibility. But we can't escape it.

More than that, to win the public confidence our industry must have, oil men should be willing to take the public into their confidence. That means the oil man should be ready to tell his side of the story in a forthright and candid manner whenever any action of his is questioned or blamed.

You know how most of us feel about the man who pleads the Fifth Amendment to conceal his political past. Well, to an outside observer it doesn't look good when an oil man—by his silence on any question—appears to plead the Fifth Amendment before the court of public opinion.

This, remember, is the court we must go before and convince. In some states we can't expect a friendly jury as matters stand now. There has been too much mud slung on us for that. But to win our case we must be prepared to go where the mud is thickest. We must go out among the unconverted and let them hear a side of the story that many of them never really heard before, many have never been willing to hear—your industry's side of the story.

The Bible tells us that there is "a time to keep silence, and a time to speak." This, I submit to the judgment of every oil man, this is surely the time for us to speak.

But the industry, as such, has no voice. The only way it can speak is through the voices of individual oil men. And many voices must be raised so they can be heard above the incessant din of our critics. For the sake of our industry, and its future, for the private enterprise American system we cherish, we must all speak—and speak boldly and plainly in defense of the oil business.

No one can hope to escape hurt if public misunderstanding, created by leftwing agitation, leads to legislation that injures any branch of the oil business. We are all limbs of the same body. An injury to one branch would affect our industry the way a broken leg affects a man. Only his leg is in a cast, but his whole body is in a wheelchair.

This industry has never been cowed by any challenge. This is no business for the faint-hearted and never was. So let's address our public and government relations problems with the same spirit that conquers business problems.

3. Specific Tasks

To be effective, we must pinpoint our activities. Abstractions, unless translated into action, will get us nowhere. I have a number of specific suggestions of which at least two or three should appeal to each of you.

. . . **I have already urged** all oil people to conduct themselves properly.

. . . **Secondly,** I urge each of you to know your industry. Become articulate about these things. The affirmative, constructive progressive things our industry has done overshadow and dwarf whatever shortcomings there may be.

. . . **Third,** let's solve our intraindustry differences among ourselves. Many of the attacks made on us originate when one branch or another of the industry airs these differences publicly and gives our critics an opportunity to distort into something evil what are really honest problems that are inherent in any major competitive business.

. . . **Fourth,** I feel that all the companies that make up our industry, large and small, should do more effectively their job of seeking to win public understanding and support of their operations and policies. Much is now being done in this quarter. But I believe a better job can be done in the education of employes and dealers and in keeping their community neighbors informed.

. . . **Fifth,** all oil people, irrespective of the branch they are in or the jobs they hold, can participate in the work of the Oil Industry Information Committee—the O.I.I.C. In that fruitful vineyard there is work to be done by everyone.

. . . **Finally,** I urge each of you to support financially and with your sympathetic interest and your active participation the public relations programs of all our oil trade associations and groups. Above all, don't be a sideline critic. If you believe they lack full effectiveness, participate in these activities and help make them more effective.

4. Defend or Die

This is no easy assignment ahead of us. We are not fighting for any temporary or modest goal. This industry is fighting for its life. Nothing less than that. Our most active and outspoken critics leave no doubt about their objectives. They are in a lynching mood. Their aim is the complete nationalization of oil and all its workings.

During the debate on the Harris-Fulbright bill last February, one senator declared: "Gas and oil companies are public utilities and are monopolies because gas and oil are a part of the resources of our country, with which God Almighty has blessed all the people, whether they live in the state where gas and oil is produced or not."

Should this claim ever be accepted as fact, it could be used to destroy the petroleum industry as a private enterprise. And after the petroleum industry was destroyed, private enterprise in agriculture would be wiped out with the very same argument.

For if oil is a monopoly and a public utility because it is a natural resource, then the soil is a monopoly and a public utility, too. So is the iron and steel industry. And the real-estate business that deals in land. And coal and copper and the fisheries.

Alone and by itself the oil industry is worth fighting for. But now the issue has been clearly drawn: We are fighting for freedom itself against those who would engulf us with creeds that have brought more misery to the world than all the plagues of the Middle Ages.

Either the oil industry stays free or one by one the lights of private enterprise will go out and the darkness of authoritarian government will settle over our land.

There is, indeed, as the Bible says, "a time to speak," and that time is while there remains enough freedom in this country so we can speak. Let's use this freedom while we have it. Let's use it with all our might and all our courage. Let's use it so we may preserve it and hand down intact to future generations of Americans the cherished rights we have inherited from those who were willing to speak, to fight and to die, if necessary, whenever a free country, and a free people, needed defenders.

Such defenders are needed more than ever now. I hope they will come in great numbers from the ranks of our industry, from oil men who see the present peril and know that this is "a time to speak."

Ike May Support New Gas Bill

AMARILLO, Tex.—A feeling in some industry quarters that the Eisenhower administration will take an active part in the next attempt to free natural-gas producers from federal regulation at the well-head was given considerable support here recently.

Dillon Anderson, special assistant to the President and chairman of the National Security Council, said the President still feels such legislation is needed, and that "it is reasonable to expect that it will be enacted."

Anderson was the final speaker at the annual meeting in Amarillo of the Panhandle Producers and Royalty Owners Association.

He told the group that the administration is firmly committed to protecting the American competitive system. This system "under which we long have operated, and the incentive to prospect for, find, and produce petroleum products, can and must be preserved. And, indeed, herein lies the greatest consumer protection."

He added that "needed legislation on the subject, in the President's view, should recognize the national interest in an assured supply of gas; further the long-term interest of the consumers in plentiful supplies; and, at the same time, protect the consumers in their right to fair prices."

More oil needed . . . E. O. Thompson, Texas Railroad Commissioner, deplored the speed with which demand is overhauling supply of United States oil. Producers, he said, must find more.

A major field of 1,000,000,000 bbl. or more has not been found in the United States in years. Meanwhile, consumption domestically last year was nearly five times as much as oil discovered in new fields, he pointed out.

New officers . . . Heading up the association for the next year will be John O'Brien, Amarillo, succeeding Lawrence Hugy, also of Amarillo.

Other new officers are George Cree, Jr., Pampa, first vice president; John Turner, Borger, second vice president; F. V. Wallace, Amarillo, secretary; Frank Storm, Jr., Amarillo, treasurer; and W. C. Stallings, Amarillo, executive vice president.

In private hands a year . . .

. . . Synthetic Rubber Moves Fast

WASHINGTON.—The year-old privately owned synthetic rubber industry, based on petroleum, is a lusty infant.

Starting with government plants having an annual capacity of 950,000 long tons, it has developed an output of over 1,250,000 tons in its first 8 months and is still growing.

President Eisenhower told Congress last week that by the end of next year it will have a capacity of 1,700,000 tons. That is an amount of rubber—synthetic and natural—which this country is not expected to need before 1960, the President said.

Part of this increased output may be in a new rubber that will free the U. S. forever from dependence upon remote sources. A number of companies are racing to come out first with a synthetic "natural" rubber. Three already have reported the successful synthesizing of material with composition and properties similar to natural rubber, Eisenhower disclosed. Large scale commercial production appears unlikely for the next few years, however.

The three objectives laid down by Congress in ordering sale of the government's rubber plants have been achieved, the President noted.

The plants were sold at their full fair value. They not only returned the $700,000,000 the Government had put into the industry, but gave a profit of $22,500,000. Additional profit will be derived from the sale or long-term lease of the alcohol butadiene plant at Louisville and the government laboratories at Akron, Ohio.

And while the President did not mention it, the privately owned industry will turn large sums into the Treasury in the form of taxes which were not levied against the plants in government ownership.

The interests of the public and small users of rubber have been protected by the industry itself. And the third objective, national security, has been met by clauses in sales contracts insuring availability of production in the event of an emergency.

Need for natural . . . A synthetic "natural" rubber would fill a gap in both the rubber economy and national security, the President pointed out.

Present synthetics are not suitable for large truck, bus and airplane tires and certain other purposes. Forty per cent of the rubber demand still must be met with natural. In volume, imports of natural are still as great as before World War II.

The President, however, sees no need now for government action to promote the development of a "natural" rubber. While important in the long run, he said, there is no immediate security problem because the U. S. has an adequate stockpile of natural rubber.

"It is believed," he added, "that we can rely upon the private synthetic rubber industry to move from laboratory synthesis to commercial production of synthetic 'natural' rubber. Pilot plants are already being constructed on private initiative."

In the event of need, Eisenhower pointed out, new synthetic capacity can be created in one-third the time required to bring rubber trees to maturity. In the long run, the improved techniques now available for natural-rubber production will make it possible for those producers to share in the ever-growing world rubber demand, he said. But he did not go into the impact of expanded synthetic production on our relations with countries whose economy depends on natural-rubber exports.

Navy Delay Asked

San Nicolas case may set off drilling investigation

WASHINGTON.—The Navy Department is being asked to hold up its plans for testing the oil possibilities of San Nicolas Island pending a study of the department's claimed authority to drill any area under its control.

The request comes from Rep. Clair Engle of California, chairman of the House interior committee. Last month the committee held a hearing at which there was disagreement over the scope of the Naval Petroleum Reserves Act.

Navy officials contend they have a mandate from Congress to find and develop new naval oil reserves. San Nicolas Island, off the coast of California, is selected for the first test because it has oil possibilities long known.

West Coast members of Congress, however, take issue with the department. They claim it has authority only to drill in naval oil reserves, and has no blanket permission to wildcat in other areas.

Engle asks Navy Secretary Thomas to hold up the work while the judge advocate general reviews the law. Anyway the department can't take any action toward drilling until Congress provides the money. So it is expected the department will attempt to marshal new arguments supporting its position to counter opposition of the interior committee.

Testing Continues

Upper-zone perforations planned at R. & B. well

PORT SULPHUR, La.—Richardson & Bass is extending the perforations in its record-depth oil producer to test other possible productive zones.

The 1-L Humble-L.L.&E. flowed clean 38°-gravity oil for about 10 days. But the producing rate has fallen off since the well was opened up. A late gage showed it flowing 200-250 bbl. of oil daily on a ⅛-in. choke with 2,000 psi. tubing-head pressure. On first test it showed 500 bbl. of oil daily at 7,000 psi. from the Miocene sand at 21,443-65 ft. *(The Oil and Gas Journal, April 30, page 84).*

As soon as the well is killed, operator plans to perforate at 21,419-35 ft., a sand body above and apparently separated by a shale break from the interval already shown productive.

Richardson & Bass had intended to perforate the 21,419-35 ft. interval at the same time as the 21,443-65 ft. but the well kicked as soon as the lower zone was opened. There reportedly are other sands that look promising and could be tested if this zone is not commercial.

Richardson & Bass officials are optimistic about their chances for a profitable completion in the 21,419-65 ft. sand. They are especially pleased that the record-depth oil is "live" and not a residual fluid.

Richardson & Bass, along with John W. Mecom, Freeport Sulphur Co., and others, has invested more than $2½-million in the venture thus far.

Kermac to Buy Refinery

OKLAHOMA CITY.—Kerr-McGee Oil Industries, Inc., plans to buy the 20,000-bbl. daily Cushing refinery it leased a year ago from General American Oil Co., Dallas, for $3,500,000.

The plant will be modernized to upgrade product quality. Braun & Co. is making a study to determine what units should be added.

The Cushing plant has been supplying feed stock for the 1,840-bbl. Platformer at the old Johnson Oil Refining Co. Cleveland, Okla., plant purchased recently from Gaseteria, Inc. The Cleveland refinery is shut down except for the Platformer, which is expected to be moved to Cushing *(The Oil and Gas Journal, April 2, page 87).*

Kerr-McGee acquired the Cushing lease when it bought refining and marketing properties of Deep Rock Oil Corp. a year ago. Deep Rock, since operated as a subsidiary, is being absorbed as a division of Kermac.

Government loan in offing . . .

. . . Trans-Canada Looks Better

OTTAWA.—The Canadian Government was reported ready last week to remove the major financial obstacle blocking a start on the 2,200-mile Trans-Canada natural-gas pipeline.

The government was understood to be planning to loan $80 million to Trans-Canada Pipe Lines, Ltd., in a move to get construction started this spring on the 900-mile western leg from Alberta gas fields to Winnipeg. Prime Minister St. Laurent called a special session of the cabinet last Tuesday to discuss Trans-Canada's financial status.

The governments of Canada and Ontario have already agreed to set up a $118-million crown corporation to build the 657-mile segment across northern Ontario. Markets there are too small to justify private construction. The projected loan would mean that Canadian taxpayers would be putting up about half the $375 million total cost of the Alberta-Montreal line.

The Canada-Ontario agreement for the crown corporation expired last week. But it's understood to have been renewed verbally. The federal government will request a formal extension later. It is expected that this letter will assure Ontario that the Canadian cabinet will approve the $80-million loan.

The government aid would go a long way toward proving Trans-Canada's financial ability to build the line. This point must be put across if the other major hurdle is to be cleared. That is approval of the Federal Power Commission to import 2000,000,000 cu. ft. daily of gas from Trans-Canada into the Midwest by an affiliate of Tennessee Gas Transmission Co. T.G.T. would in turn export 86,755,000 cu. ft. daily to develop eastern Canadian markets pending completion of the all-Canadian pipeline.

It remains to be seen what effect, if any, a rival proposal will have on Trans-Canada. An offer to build the line without government help was presented last month by a group headed by Frank H. McMahon, president of Westcoast Transmission Co., Ltd., and Pacific Petroleums, Ltd. *(The Oil and Gas Journal, April 16, page 120).*

Processing BRIEFS

LINDEN, N. J.—Esso Research & Engineering Co. is erecting three new buildings to serve the Esso Research Center here. They include a five-story office structure, a garage for company vehicles, and a storehouse. Completion is due in March 1957.

MONTREAL EAST, Quebec.—Shell Oil Co. of Canada will expand its petrochemical facilities here to produce methylethyl ketone and secondary butyl alcohol. Production will supplant imports of these key chemicals. Shell's existing chemical plant, built in 1953, produces acetone and isopropyl alcohol. New facilities are expected to be in operation late this summer.

LINDEN, N. J.—General Chemical Division of Allied Chemical & Dye Corp. will build a sulfuric acid plant here. A 120-acre site has been obtained on Newark Bay. Raw stocks, including spent acid, will be supplied by Esso and other industries in the Elizabeth-Newark area. General Chemical plans eventually to expand the plant into a major chemical production center.

NEW ORLEANS. — Jefferson Lake Sulphur Co. has announced plans for large-scale production of sulfur from sour gas in the Peace River area of Alberta and British Columbia. The company has contracted with Pacific Petroleums, Ltd., for construction of several plants including sulfur-extraction facilities with an initial capacity of about 100,000 long tons annually.

TORONTO.—British American Oil Co. is considering adding catalytic reformers to its refineries at Edmonton, Alta., and Moose Jaw, Sask. M. S. Beringer, British American president, told the annual stockholders meeting that the 21,500-bbl. daily refinery at Clarkson, Ont., also may be expanded.

BARTLESVILLE.—Phillips Chemical Co. will build a sulfur plant in Andrews County, West Texas, to supply about 60 long tons of sulfuric acid a day for its fertilizers. Completion is expected next summer.

EL PASO, Tex.—Standard Oil Co. of Texas is preparing to ask for bids for the $25,000,000 construction program it announced for its El Paso refinery earlier this year. Construction is expected to get under way in from 3 to 4 months. The program will hike refinery charge capacity from the present 36,000 bbl. to 61,000 bbl. a day.

Alaska Deal Made

● Colorado Gas & Oil gets contract to develop block of 1¼ million acres

WASHINGTON.—A 1,250,000-acre segment of Alaska's potential oil lands was opened to development last week by the Interior Department *(The Oil and Gas Journal, April 23, page 85).*

Acting Secretary Clarence A. Davis signed a contract permitting Colorado Oil & Gas Corp. to explore and develop a 90-mile strip along the Gulf of Alaska, running approximately 125 miles from Icy Bay to the Glacier Bay national monument at Cape Fairweather. The land is adjacent to the equally big area now under development by Phillips Petroleum Co.

Signing of the contract ended a 3-year effort by the Yakutat Development Co. to open the lands.

Colorado's contract calls for the expenditure of not less than $250,000 in the next 2 years, another $250,000 in the following 2 years, and similar sums annually in the fifth and sixth years. It is to drill an exploratory well not later than July 1, 1959.

The effort to open the area started in 1953. Each lease offer was accompanied by an irrevocable power of attorney to Yakutat and certain other rights to negotiate development contracts.

The leases were rejected by the Anchorage office of the Bureau of Land Management on the ground they would make the company "the real party in interest" and chargeable with acreage far in excess of the 100,000-acre maximum that could be held by a single individual, association or corporation in Alaska.

The Anchorage action was appealed to Washington, under a provision of the Mineral Leasing Act permitting a greater acreage where it is to the advantage of the Government and the territory to encourage development that would not be economic on a smaller scale.

Yakutat met the department's objections by renouncing power of attorney and other rights, except to select a bank to act as agent for receiving and distributing funds it would receive under the operating agreement. Colorado will pay a cash bonus to the lessees, a 5 per cent overriding royalty, and 12.5 per cent of the profits from production. The cash bonus amounts to $1,050,000.

The second operating agreement was submitted April 19. At that time, department officials were told that if it were signed by May 1, Colorado plans to start this summer on a 2-year initial exploration program. Some 350 of the 470 leases already have been issued.

Gulf Steps Up Plant Projects

PORT ARTHUR, Tex.—Gulf Oil Corp. is undertaking another modernization program at its refinery here on the heels of a 5-year building program now nearing completion.

Work scheduled for this year and next includes a new packaging and grease plant, enlargement of the machine and boiler shops, expansions in the polymerization, alkylation, and sulfur-recovery units.

Gulf officials announced that a 186,000 sq. ft. plant will be completed by the fall of 1957 for blending, compounding, and packaging lubricating oils, greases, and specialty products.

Work on the processing units will be completed earlier in the year. Units involved are:

. . . Sulfur - recovery unit — will be doubled from its present 60 tons daily capacity to 120 tons. This will enable the unit to handle off-gases from the new fluid catalytic cracking unit and two Gulfining units now under construction.

. . . Polymerization plant — will also be doubled in size to a 5,000 bbl. daily unit.

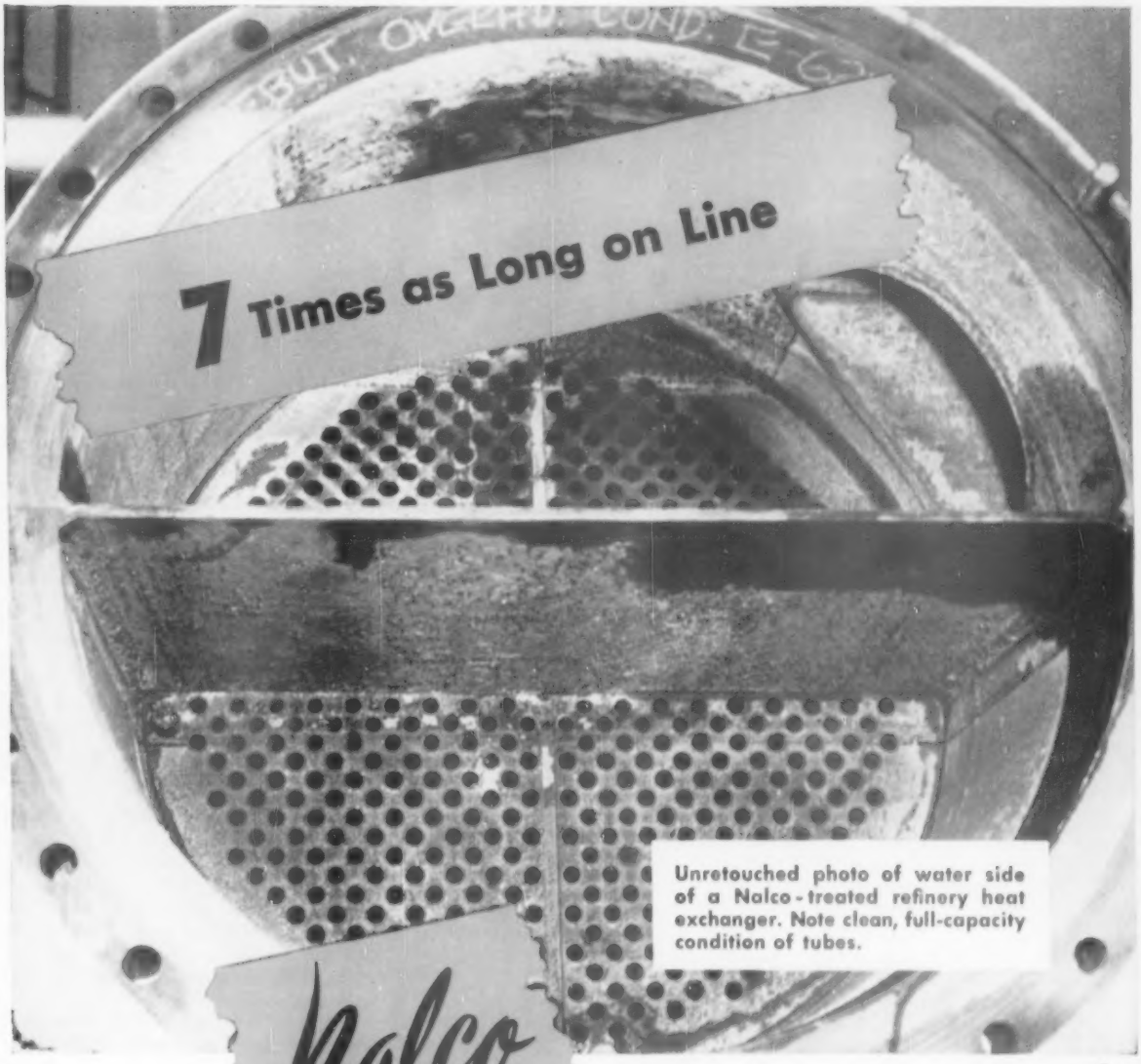
. . . Alkylation unit—a new reactor system will be added to Unit No. 1 to increase its capacity from 1,200 to 4,000 bbl. daily.

. . . Acid plant—four sludge decomposing units will be added to the two installed in 1952.

Emphasis on quality . . . Gulf has concentrated its recent expansions on improving quality of products and has added only about 10 per cent to the crude capacity of its 272,000-bbl. refinery here.

A fluid catalytic cracking unit completed recently added 68,500 bbl. daily of cracking capacity to the plant but did not increase over-all throughput. Also a 100,000-bbl. two-stage crude distillation unit replaced an outmoded facilities with little affect on throughput.

Other recent improvements at the plant include a 29,000-bbl. per day catalytic reforming unit and two ethylene plants with a combined capacity of 1,000,000 lb. daily. This represents about 15 per cent of the nation's total ethylene capacity.


7 Times as Long on Line
Unretouched photo of water side of a Nalco-treated refinery heat exchanger. Note clean, full-capacity condition of tubes.

SINCE *Nalco* TREATMENT TOOK OVER

This refinery heat exchanger was a prize example of plugging and corrosion headaches before Nalco System treatment was applied to the cooling water. After *7 times as long* as average previous runs, the exchanger was opened for inspection and found clean and corrosion free.

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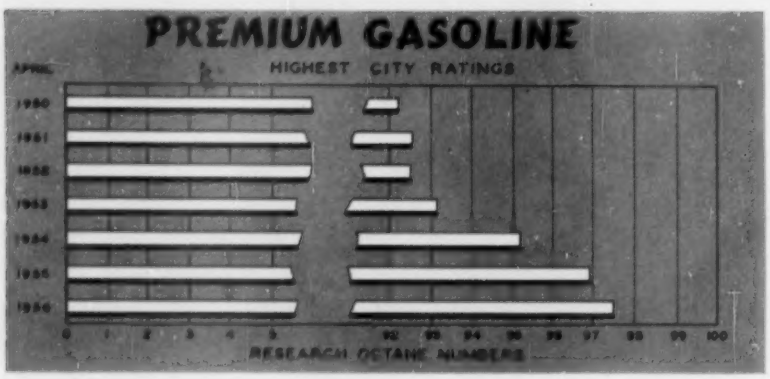
Octanes Climb Slightly in First Quarter



Du Pont Survey Figures Tell the Story

	PREMIUM				REGULAR			
	Octane number			TEL cont. cc./gal.	Octane number			TEL cont. cc./gal.
	Apr. 1955	Jan. 1956	Apr. 1956	Apr. 1956	Apr. 1955	Jan. 1956	Apr. 1956	Apr. 1956
Aberdeen	91.3	94.0	94.0	2.38	84.8	85.7	86.1	2.17
Amarillo	93.0	96.7	96.2	2.35	84.4	87.4	87.6	2.48
Atlanta	95.8	96.8	96.8	2.28	87.5	89.5	89.7	2.44
Bakersfield	93.2	95.0	95.1	2.93	83.8	86.0	85.8	2.48
Baltimore	96.6	96.8	97.0	2.54	90.0	91.6	91.7	2.55
Boston	96.1	96.8	96.6	2.26	90.4	91.3	92.2	2.35
Calgary	89.9	90.9	90.7	2.67	83.1	84.3	84.0	2.37
Casper	90.4	92.4	92.5	1.44	83.7	85.2	85.2	1.87
Charlotte	96.0	96.8	96.8	2.38	88.5	89.4	89.8	2.45
Chicago	93.9	94.9	95.2	2.50	85.6	89.1	88.9	2.19
Cincinnati	94.7	95.2	95.7	1.85	89.0	90.2	90.5	2.20
Cleveland	94.7	95.3	95.7	2.09	89.2	90.8	91.3	2.10
Columbus	94.3	94.9	96.0	2.02	89.2	90.0	90.7	2.00
Corpus Christi	96.5	97.0	97.2	2.84	86.7	88.6	88.4	2.66
Dallas—Fort Worth	96.4	96.9	97.2	2.63	86.5	88.1	88.0	2.62
Davenport		94.0	94.2	2.24		86.9	87.0	2.15
Denver	90.4	91.8	92.5	1.77	84.1	85.3	85.8	1.64
Des Moines		93.8	94.1	2.20		86.9	86.4	2.17
Detroit	94.6	95.2	95.9	2.33	88.8	90.2	90.7	1.96
Edmonton	90.1	91.3	91.2	1.78	83.8	84.7	84.3	1.56
El Paso	92.7	95.5	95.6	2.51	82.3	86.0	86.0	2.28
Great Falls—Billings	93.2	94.1	94.4	1.84	86.3	86.8	86.4	1.68
Houston	96.9	97.4	97.5	2.81	87.1	88.7	89.0	2.70
Indianapolis	93.9	95.4	96.0	2.21	85.7	88.4	89.6	1.87
Jacksonville	96.0	97.1	96.7	2.39	89.6	90.5	91.1	2.48
Kansas City	92.8	94.2	94.4	2.60	84.5	86.7	86.8	2.33
Little Rock	96.3	97.5	97.5	2.78	87.5	89.0	89.0	2.39
Los Angeles	94.7	95.9	96.0	2.55	84.8	86.0	86.1	1.36
Louisville	95.4	96.7	96.4	2.45	87.7	89.6	89.5	2.32
Memphis	95.7	97.2	97.0	2.62	87.5	89.8	89.5	2.41
Milwaukee	94.8	95.3	95.1	2.26	85.6	89.4	89.0	2.11
Minneapolis	92.5	94.5	94.7	2.03	85.0	86.3	86.5	1.82
Montreal	92.7	94.8	95.1	2.19	89.1	89.5	89.5	1.87
Nashville	96.0	96.9	97.4	2.64	88.0	88.9	89.2	2.48
New Orleans	96.3	96.8	96.7	2.66	87.7	88.9	88.8	2.59
New York	96.1	96.8	96.7	2.67	89.8	91.9	92.0	2.57
Omaha	92.2	94.4	94.3	2.26	85.0	86.4	85.9	2.06
Philadelphia	96.5	96.8	96.4	2.27	90.2	91.6	91.6	2.37
Pittsburgh	96.0	96.8	96.5	2.35	89.7	91.8	91.9	2.53
St. Louis	93.6	94.7	94.6	2.39	85.9	86.9	86.8	2.24
Salt Lake City	90.1	92.5	92.3	1.52	81.6	82.2	82.2	1.79
San Francisco	94.5	96.1	96.6	2.57	85.0	87.0	86.4	1.40
Seattle	94.2	95.9	95.8	1.96	85.5	86.4	86.6	0.98
Shreveport	95.9	97.2	97.1	2.82	87.5	87.7	88.8	2.60
Spokane	94.0	96.0	95.8	1.92	84.4	86.3	86.4	1.44
Toronto	93.8	95.3	95.1	2.25	88.4	88.9	89.2	1.51
Tulsa-Oklahoma City	93.0	94.6	94.6	2.49	85.6	86.8	86.6	2.11
Vancouver	92.7	94.5	94.5	1.23	84.6	85.4	85.5	0.89
Wichita	92.1	93.9	94.2	2.21	84.6	86.3	86.6	1.94
Winnipeg	92.1	92.5	93.8	1.73	86.0	86.5	87.2	1.16

OCTANE quality of gasoline changed very little during the first quarter of the year, according to the latest Du Pont survey.

For the first time, the company reported changes based on weighted averages for the country as a whole. The United States average for premium gasoline in April was 96.0 research-octane numbers compared with 95.9 at the first of the year.

The weighted average for regular gasoline in the United States was 89.0 octane, up 0.2 from the average of 88.8 shown by the January survey. Premium and regular combined had a weighted average of 91.1, up 0.2 of a point.

No averages were calculated for all of Canada, but premium for Toronto and Montreal topped all other areas, with averages of 95.1 each. The highest sample rated 96.3 octane. Regular gasoline at Montreal averaged 89.5 octane, the highest for Canada.

The general upward trend in octane quality is shown in the chart and also by the table below. The peak city-octane number has moved up about one number a year over a period of 5 years. But most of the gain has been in the past 3 years.

As late as April 1951, the highest city average for premium was 92.6 octane. This had increased to only 93.2 by April 1953. On the latest survey, both Houston and Little Rock had premium averaging 97.5. Two samples in the survey tested 98.6 octane. One was from Houston and the other from the Dallas-Fort Worth area.

Boston and metropolitan New York were the only areas with regular gasoline averaging 92 or better. Boston was 92.2 and New York was 92.0.

Note in the table below that in April 1954, no city had regular averaging as much as 90 octane, and only six areas measured 88 or better.

SHIFTS IN OCTANE RATINGS

(Cities per octane group)

Octane group—	Apr. 1954	Apr. 1955	Jan. 1956	Apr. 1956
Premium				
97 octane and over			6	8
95-96.9	1	17	24	25
93-94.9	20	17	14	12
91-92.9	17	9	5	4
Below 91	10	5	1	1
Total tested	48	48	50	50
Regular				
92 octane and over				2
90-91.9		3	10	8
88-89.9	6	11	15	16
86-87.9	13	11	18	16
Below 86	29	23	7	8
Total tested	48	48	50	50

RETARDED ACID

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Retarded acid saves its strength . . . just long enough to travel far out from the well bore before attacking limestone full force. And the farther it travels, the farther this efficient Dowell acidizing treatment enlarges your well's drainage area—the more it increases permeability to improve oil recovery for you.

A special additive delays Retarded Acid's punch. As a result, Retarded Acid works far into the pay formation before spending itself completely.

In fast-reacting vugular or fractured limestone, where normal acids spend themselves near the bore, Retarded Acid is *your best buy*. Better acidizing this Dowell way means better results for your acid dollar.

For service, or for more information about Retarded Acid, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write Dowell Incorporated, Tulsa 1, Oklahoma, Dept. E-11.

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New Coating Tested

Two pipelines experiment with spray-type product

HOUSTON. — Transcontinental Gas Pipe Line Corp. is experimenting with a new spray-type coating to control corrosion on a new 6-in. line in southern Louisiana.

Known as "Copon Arocoat," the material is basically a prepolymerized coal-tar epoxy resin with an amine curing agent. Developers of the product say it can be applied at pipe mills, coating yards, or construction sites.

Besides Transco, which applied the coating to a 2-mile section of gas line, Ohio Oil Co. is testing the coating on a 2-mile segment of 4-in. line near Orange, Tex. On Ohio's project, however, the coating includes a glass wrap between two layers of the coating material.

The project has been undergoing laboratory tests for several months.

Officials of Coast Paint & Lacquer Co., developers of the product, say it dries sufficiently so that coated pipe may be lowered into the ditch in about 3 hours. Curing continues at a relatively fast rate for several days and at a reduced rate for a longer period.

Time saver . . . In field applications, use of the paint-like material may reduce time consumed in coating and wrapping. Developers stress that quicker-acting curing agents may be found which would further reduce drying time.

Thickness of the coating may vary from 6 to 20 mils, depending on customer specifications, severity of conditions, and the amount of cathode protection used on a particular line.

Coal tar, which has been used in pipe coatings for years, has high moisture resistance. Epoxy resin has an affinity for metal and has been used for internal coating of pipe as well as for protecting offshore drilling platforms from corrosion. When mixed, coal tar and epoxy resin are said to fortify each other. Addition of the amine curing agent causes a chemical reaction resulting in a cross linking of these elements.

The coating will be manufactured by Copon Associates, a group of 12 companies in various parts of the country which have been licensed for that purpose.

Ethyl Strike Settled

HOUSTON.—A 32-day strike at Ethyl Corp.'s Pasadena, Tex., plant ended last week after the company threatened to hire new employes to replace striking members of the Oil, Chemical and Atomic Workers International Union.

A settlement was reached within 2 days after the company delivered its ultimatum. Terms of the agreement provide a 6 per cent general wage increase retroactive to February 1; plus 8 and 16 cents per hour increases in shift differentials.

A company spokesman said supervisory employes were able to maintain full production while more than 650 union workers were idle.

New Gilsonite Uses

Paving materials will be produced in unique plant

FRUITA, Colo.—American Gilsonite Co.'s nearby $12,000,000 project for the production of coke and gasoline from gilsonite is the first step in the development of a much larger enterprise.

Several other plans are now under laboratory study. One involves production of road-paving materials, which the company hopes to use on roads in this area of Western Colorado.

A. F. Goodner, president, said all roads at the 1,200-acre plant site will be test-paved. Cost, he said, should be no higher than with present paving materials.

Goodner said the delayed coker, fractionator, and catalytic reformer now under construction should be ready for operation by November *(The Oil and Gas Journal, July 11, 1955, page 90).*

A 6-in. pipeline will move gilsonite in a slurry from Bonanza, Utah, 80 miles away, at the rate of 3½ ft. per second. The line will cross White River on an 1,800-ft. bridge. The slurry will be 40 per cent gilsonite and 60 per cent water.

The plant site will be known as Gilsonite, Colo.

City Accepts Humble Bid

LIBERTY, Tex.—This small East Texas city has accepted a bid of $55,750 for mineral rights under public streets.

The bid was resubmitted by Humble Oil & Refining Co., which had offered the same bonus last December. The earlier offer was not accepted because of a technical error in bid advertisements.

Humble also has leased much of the west side of town from private owners. Reports last week indicated Stanolind Oil & Gas Co. has entered the play by seeking leases on the opposite side of town.

Cement Record Set

10,335 ft. single column is run at Phillips well

BARTLESVILLE, Okla.—The longest single-stage oil well cement column ever run is the accomplishment claimed by Drilling Specialties Co. of Bartlesville. The job was done with the company's new Diacel D Cement by Halliburton Oil Well Cementing Co.

Drilling Specialties officials reported the record cementing was performed on 7-in. casing at the 2 Evelynjo of Phillips Petroleum Co. in the Puckett pool of Pecos County, West Texas. Operator wanted to obtain complete fill up from 10,335 ft. to surface in a single-stage cementing operation.

The 7-in. casing was set at 10,335 ft. and cemented with a 11-lb. per gal. density Diacel cement. Hole size was 8¾-in. A total of 4,087 cu. ft. of slurry was desired. This included 20 per cent excess or 681 cu. ft. as a precautionary measure based on caliper log measurements.

The blend was mixed with about 25.6 gal. of water per sack of cement. This provided an easily pumpable slurry having an A.P.I. simulated well thickening time of 3 hours at 10,000 ft. and 230° F. temperature. Some 400 cu. ft. of the 681 cu. ft. excess was circulated. No stage collars were used. Top of the plug was 9,978 ft.

Cement was drilled out after 24 hours and the open hole acidized from 10,335-10,462 ft. with 1,000 gal. acid. The well tested at an average gas rate of 4 million cubic feet per day with some distillate.

Wilshire to Expand Refinery

LOS ANGELES.—Wilshire Oil Co. of California has contracted with Southwestern Engineering Co. for design and construction of a 10,000-bbl. per day Unifining-Platforming unit at its Norwalk refinery.

The $2,750,000 contract is the first step in an over-all modernization and expansion program which will double capacity of the 25,000-bbl. per day plant. Completion of the new refining unit is scheduled for next January.

Also planned: a 25,000-bbl. per day crude unit, including a 15,000-bbl. vacuum section; a 9,500-bbl. fluid catalytic cracking unit; and a straightrun asphalt unit to turn out 3,200 bbl. per day of product.

The expansion was announced earlier this year, following acquisition of Wilshire by Malco Refineries, Inc., of Roswell, N. M.

THE CALIFORNIA COMPANY, LOUISIANA GULF COAST

DESIGNS, ENGINEERS, and BUILDS COMPLETE
PACKAGED GAS COMPRESSOR PLANTS

Southwest erects complete gas compressor plants:-engineering, compressors, barge, building, on one purchase order and with single responsibility from beginning to end. The floating unit shown above was designed, pre-assembled and tested in the Southwest shops, then barge mounted, and delivered complete in 135 days. Southwest does the complete job in building compressor stations afloat, on platforms, or on land giving you faster delivery, lower *installed* cost, and undivided responsibility.

The unattended operation, possible with the automatic controls and safety devices on Southwest Packaged Compressor Plants, cuts operating cost per horsepower-hour to a fraction of the cost of a fully attended stationary installation. A Southwest engineer can show you actual comparative operating costs.

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Production by Microwave

Versatile unit being tested for lease operations; may launch automatic custody transfer and new radio system

DALLAS.—Microwave, for a long time confined to pipeline use, is now being counted on to aid producing operations at the lease level.

An 8-mile link will be installed in West Texas soon to carry data from automatic tank batteries into a central processing office.

This was revealed here last week by General Electric Co. at the joint meeting of the Petroleum Industry Electrical Association and Petroleum Electric Supply Association.

Shell Oil Co. will use the 960-megacycle microwave, probably in Wasson field where Shell has concentrated on automatic lease operation and has made tests for automatic custody transfer to pipeline.

The single-channel link will accept digital data on volume, temperature, b.s. and w. content, and gravity of oil run from an automatic-custody-transfer battery *(The Oil and Gas Journal, April 2, 1956, page 84).*

This information will feed from the microwave into a punch card machine, which will prepare the data for accounting.

As far as can be determined, the battery will not be making automatic-custody transfers in the near future.

The microwave is merely another step in the continuing tests on lease automation until the principle of automatic-custody transfer is acceptable to producers and pipelines.

This first microwave link will be a pilot installation to test the adaptability of microwave to producers operations. If successful, the system may later be branched out to include other batteries and data-collecting points in the field.

The scheme promises to open an entirely new vista for line-of-sight radio. This use of microwave is much more practical than omnidirectional very-high-frequency (V.H.F.) radio, since absolute privacy and lack of interference is obtained.

The spectrum for V.H.F. radio is now extremely crowded, and transmission of digital information by that means is risky because of possible interference.

Better radio equipment . . . Theme of the many P.I.E.A.-P.E.S.A. exhibits centered on better, more rugged, and more reliable communication equipment. On exhibit were:

. . . **A 120-voice channel** microwave terminal, with all channels operating. This equipment, shown by Collins Radio Co., is identical to that now being installed for Sinclair Pipe Line Co. and Continental Pipe Line Co. on a 700-mile system from Ponca City to Houston. Reports are that Sinclair and Continental will be using up to 90 channels at one point on the system.

. . . **A digital telemetering** system for reading out flow meter count on demand. Devised by Control Corp., the system removes a weak point of past systems in that transmitter and receiver do not have to be continually linked for the receiver to remain in synchronism.

The communication link between them may be broken for any length of time. When it is restored, the receiver merely interrogates the transmitter and obtains the correct meter reading at that time. In addition, the transmitter keeps a mechanical count of barrels throughput.

First oil-industry installation will be made by Humble Pipe Line Co. in South Texas.

. . . **A featherweight** walkie-talkie radio by Motorola, Inc., using transistors and printed circuits, and powered by long life nickel-cadmium or dry-cell batteries.

The unit weighs only 7 lb., puts out 1-watt radio power, and promises to be a blessing to well-location survey crews, seismograph jug hustlers, and others.

. . . **A new R. F. coupling** device for feeding tower-top antennas. This device has been held up by the military for over 3 years and is now being offered to the petroleum industry by Prodelin, Inc.

In essence, it allows coupling of a coaxial cable or waveguide to a single wire for feeding the antenna. The "T" mode of propagation in the co-ax is changed to a radial mode for propagation along the wire.

The method is good up to 9,000 megacycles. Losses are no more than with co-ax or waveguide. Installation and maintenance is much simpler.

. . . **A plastic dish** for microwave antennas which will use an off-center feed to improve radiation pattern. Use of the molded plastic dish will also cut costs on antennas. It may be the answer to lowering prices on scatter microwave systems.

A 28-ft. dish for a scatter installation may now cost up to $10,000. The plastic dish would halve this.

Royalty owner or operator . . .

. . . Who Bosses Oil Production?

AUSTIN. — How far can a royalty owner go in dictating how an operator produces an oil well?

Can he, for instance, sue and collect from an operator because the latter did not investigate possibilities of lower pays before plugging a well which had produced from a shallower formation?

The question may be answered by the Texas Supreme Court soon.

The court has agreed to review May 16 a case wherein an operator was sued for damages by a coholder of mineral interests and by a holder of an overriding royalty interest for alleged destruction of an oil well.

The defendant is Whitson Co., Inc., Dallas. Plaintiffs are Bluff Creek Oil Co., coholder of minerals interest, and R. H. Rucker, Jr., with the overriding royalty. Rucker also is a vice president of Bluff Creek.

The controversial well was a small producer in Whitson field of Montague County, termed by one of the interested parties as one of Montague's "conglomerate pimples."

The well was originally drilled by Bluff Creek and reportedly had shows in deeper formations before being plugged back and completed in the conglomerate.

The story, as related by J. W. Hassell, Jr., attorney for Whitson, is that some time later the well went to water. Bluff Creek entered into a deal with Whitson Co., Hassell said, whereby Whitson would take over the operation in an attempt to restore production. The latter was to take all the oil until cost of workover and similar operations (some $50,000 to $70,000) were paid out. Then the two companies would share on a 50-50 basis.

Whitson did temporarily succeed in restoring the well to production, but the oil output declined in 2 years to an uneconomical level and the company reworked the well again, Hassell said. This time the operation failed, and the well again went to water. Whitson plugged and abandoned it and was sued in District Court by Bluff Creek and Rucker for negligence during the workover and for plugging without first looking at the lower zones.

The jury awarded Bluff Creek the entire value of the well, which it placed

at $35,000, and Rucker another $8,000 in damages. The Court of Civil Appeals upheld the lower court judgment that Whitson had been negligent.

It affirmed the $8,000 damage award to Rucker but canceled out the $35,000 payment to Bluff Creek on grounds that Whitson had already spent more than that amount on the workover operations.

Whitson appealed to the Supreme Court, maintaining that it had no responsibility to Rucker, the overriding royalty owner, to investigate possible deeper pays. Since the damage award to Rucker was jointly for both counts of negligence, the entire amount would be disallowed if the Supreme Court rules for Whitson.

Paradox Hits Twice

Texaco, Superior bring in producers in Aneth region

DENVER.—Two big producers were added last week to the booming Aneth area of the Paradox basin, currently the hottest development spot in the Rockies.

The Texas Co. completed its 1 Navajo "D," an on-structure wildcat in the southeastern Utah area for 1,872 bbl. per day through open 2-in. tubing. This well is about 1 mile west of the 1 Navajo discovery well which came in last winter for 1,704 bbl. per day. Production at both wells is from Hermosa-Pennsylvanian lime.

Superior Oil Co. completed the 1 Navajo-A well for 605 bbl. per day on 48/64-in. choke. This well is the confirmation to the field's discovery well. Texas is running tests at the 1 Navajo E, fourth apparent producer for the field. Three other wells are drilling in the field.

This highly regarded Paradox basin discovery area is at the north end of the Navajo Indian Reservation, 12 miles northeast of Desert Creek production.

City Dump Brings $25,200

HOUSTON.—The Houston City Council last week accepted the lone bid of $25,200 for drilling rights on a 300-acre city garbage dump.

The lease went to Trice Production Co., Longview, Tex. The company announced plans to start its first well on the lease within 30 days.

Several members of the council expressed disappointment that the lease sale had not attracted more and higher bids *(The Oil and Gas Journal, April 30, page 85)*. The dump is on the east flank of Pierce Junction field.

Harris-Fulbright Lobby Denied

WASHINGTON.—The General Gas Committee did not lobby for the Harris-Fulbright gas bill, a special Senate investigating committee was told last week by Maston Nixon, G.G.C. chairman.

Nixon, president of Southern Minerals Corp., told the committee his company has never sold gas interstate because of fears of federal regulation.

His interest in the Harris bill, he said, arose from his belief that regulation of gas at the wellhead was the first step toward regulation of oil.

The committee, discussed in 1953 while the Phillips case was pending in the lower court and formed in 1954, was set up to work for passage of the bill.

But it confined its efforts to "developing the facts and carrying these facts to the people and to their representatives and senators in Congress," Nixon declared.

"We made no campaign contributions. We spent our money to build our case on the facts and tell our story based on those facts."

Nixon gave the Senate committee all of the gas committee's financial accounts and lists of members and contributors. Its top membership was 667, of whom 249 contributed amounts ranging from $25 to $3,855. A total of $119,988 was raised and spent.

Sen. Clinton P. Anderson of New Mexico noted that Superior Oil Co. contributed $200.

Nixon said he did not know Howard Keck, president of Superior, but that he is acquainted with Elmer Patman, Superior attorney who was involved in the $2,500 offer, to Sen. Francis Case of South Dakota, which led to veto of the Harris bill by President Eisenhower.

Under questioning by Chairman John L. McClellan of Arkansas, Nixon said neither he nor the committee made any improper attempts to influence any member of Congress.

He said that, so far as he knew, no member of the committee made any such effort as an individual or company official. He told the committee he knew of no attempts to influence Congress improperly by anyone either for or against the Harris bill.

Nixon appeared before the committee at a special hearing arranged because he is going abroad this week. The committee is just completing its staff and is not expected to really start its probe of lobbying for another month.

Industry BRIEFS

NEWPORT NEWS.—The Texas Co. launched its 25,510-ton tanker, SS Florida, here last week. The ship has a cargo capacity of 6,443,598 gal. of petroleum and products, and a designed service speed of 18 knots. It is 565 ft. long.

The tanker is expected to be commissioned for service, following extensive sea trials, by July 20. It was christened by Mrs. John S. Worden, wife of Texaco's vice president in charge of refining. Construction was at the Newport News Shipbuilding & Dry Dock Co.'s shipyard.

OKLAHOMA CITY. — Oklahoma's May crude-oil allowable has been cut 15 per cent on a per well basis. The Oklahoma Corporation Commission said the move was designed to combat the spread of purchaser proration buying, which has caused unratable taking of crude in about 300 pools in the state. Estimated state-wide production permitted under the order: 585,000 bbl. daily.

COALINGA, Calif. — Construction has begun on a 15-mile, 4-in. pipeline from the Coalinga Nose field to Kettleman City. The $250,000 line, which is being built by the Caminol Co. of Hanford, will carry crude from The Texas Co. wells in the Coalinga area.

OKLAHOMA CITY.—A 104-page study of underground storage of liquid petroleum hydrocarbons in this country has been released by the Interstate Oil Compact Commission. The publication, available for $1 per copy from I.O.C.C. headquarters, Oklahoma City, represents 4 years' work by the commission's research committee and state committees throughout the U. S. It deals with the geologic and engineering aspects of underground storage, describes current projects, and discusses possibilities for other storage facilities.

BARTLESVILLE. — Cities Service Oil Co. increased crude purchases to about 80 per cent of the normal 90,000 bbl. daily May 1. Purchases were cut 40 per cent April 1 as a result of a strike at the 53,000-bbl. Cities Service refinery at East Chicago, Ind. The company has found outlets for some of the crude which it normally uses.

Refund Still Holds

Only six tracts up for May 15 leasing to be effected

NEW ORLEANS.—The U. S. Department of Interior likely will refund money paid for offshore leases May 15 if tracts involved later are determined to belong to Louisiana.

S. M. Groom, Jr., manager of the Interior Department's outer Continental Shelf office here, said several inquiries had followed a story in The Oil and Gas Journal regarding the dispute over tidelands ownership. The article stated that the department had notified interested parties "that accepted bids on disputed tracts will not be refunded when the boundary question is settled" *(The Oil and Gas Journal, April 30, page 85).*

This stipulation in the sale notice applies only to six tracts bordering the 3-mile line which the federal Government contends is the boundary between federal and state waters, Groom said.

The Justice Department is pressing a Supreme Court suit against Louisiana's claim to a 3-league boundary. It also is disputing Louisiana's location of the 3-mile boundary.

Groom explained if the Government wins, the 3-mile line will become the boundary. Then the dispute will center on where the 3-mile line is, because it's often difficult in the marshy Louisiana country to determine the shore line. He declared that if later surveys determine the six blocks actually contain a few acres less than advertised, the Government will make no adjustment in the bonus paid by the successful bidder.

In Washington, Interior Department officials said that receipts from leases on all the disputed offshore tracts are not being put in escrow. They have gone into the general fund of the Treasury where they immediately became subject to appropriation and spending.

However, Congress undoubtedly would order their return should Louisiana win the boundary suit.

Computer Papers Planned

NEW YORK.—New techniques in using electronic computers to evaluate refining processes will get a thorough airing at the coming A.P.I. mid-year refining meeting in Montreal May 14-17. Six technical papers dealing with the subject will be featured in one of the special sessions.

Another subject of current interest will be Shell Oil Co.'s new two-stage fluid catalytic cracking, which provides greater flexibility, higher gasoline yields, and lower coke laydown. This will be first open panel on the process.

The octane scale above 100 will come up for some spirited comment at a special session of the committees involved.

A high degree of interest has been expressed in a special demonstration on training to meet refinery disasters. The demonstration will be presented by Du Pont.

Despite a heavy registration, there are still plenty of hotel rooms available according to the Montreal Tourist & Convention Bureau.

Drilling Firm Expands

Delta Drilling forms firm to handle offshore work

NEW ORLEANS.—Delta Drilling Co. of Tyler, Tex., has announced the formation here of an affiliate, Delta Marine Drilling Co., for offshore operations in the Gulf of Mexico.

Joe Zeppa is president and Chris Zeppa is vice president of both firms. J. M. Gardner, Dallas, is vice president of Delta Marine. Controlling interest is held by Delta Drilling.

Contracts have been awarded Alexander Shipyard, Inc., for conversion of an LST into a drilling tender and for construction of a Hayward-type submersible barge capable of operating in 30 ft. of water.

The 326-ft. tender will have diesel electric equipment and a generating capacity in excess of 2,000 hp. It should be ready for operation in June.

The barge, expected to be completed next October, will have semidiesel electric equipment, with a 2,000-hp. generating capacity. It will be equipped to drill below 15,000 ft.

Both units will be equipped with helicopter landing decks and air-conditioned quarters.

River Rights Issue Unsettled

DENVER. — There are indications that the courts will decide who owns oil and gas rights on lands underlying rivers in Colorado.

This became apparent recently when the State Land Board rejected a request by Monsanto Chemical Co. for oil and gas leases on about three-fourths of a mile of the South Platte River bed in eastern Colorado. The firm already owns oil and gas leases adjoining the river.

A. M. Ramsey, land board president, said his group would not approve such leases unless "we are legally forced to take such action."

He said the state apparently acquired the stream bed of all navigable rivers from the U. S. Government at the time statehood was granted to Colorado in 1876.

Two Fields Opened

Humble, Shell wells hit in waters off Louisiana

NEW ORLEANS.—Two more new fields have been opened in the Gulf of Mexico off the coast of Louisiana.

They are the fifth and sixth new-field discoveries in the state's offshore areas this year. They boost to 80 the number of Louisiana offshore fields.

First of the new discoveries is by Humble Oil & Refining Co. It was in Block 77, Eugene Island area, 15 miles out from St. Mary Parish.

Humble's well is 1 Federal-OCS 0466, on the flank of a previously proved salt dome. It is producing gas and condensate from a lower Miocene sand, perforated at 14,500-530 ft. Tested through ¼-in. choke, it flowed 132 bbl. of 49°-gravity fluid with 5,529,000 cu. ft. of gas per day under pressure of 3,500 psi. Hole had been drilled to 15,491 ft.

The other discovery is by Shell Oil Co. on a State lease off the tip of Plaquemines Parish's Mississippi River delta, in Block 42, South Pass Area. It is about 4 miles from nearest semblance of land, delta, marshes, adjacent the mouth of Southwest Pass.

Shell's well, 3-A State Lease 2554, was drilled to 14,040 ft. and perforated at 8,378-87 ft. It flowed at the rate of 1,745,000 cu. ft. of gas per day through 9/64-in. choke with pressure of 3,400 psi. Gas carried an ungaged condensate spray.

Two Strikes in Montana

BILLINGS, Mont.—Two important discoveries were made in Montana last week.

R. P. Oliver completed his 3 State as an Amsden-Heath transition zone discovery at Ivanhoe Dome, Musselshell County. The discovery flowed 235 bbl. of oil per day from 3,960-78 ft. on 13/64-in. choke. The well is located a half mile south of Ivanhoe field, and is separated by two failures.

This Amsden-Heath transition strike is the second Amsden area of prominence to be opened in the region in the past 15 months. Wolf Springs field in the Bull Mountain basin to the south in Yellowstone County is the other.

The other discovery in Montana is in Roosevelt County, south of Poplar field in Williston basin. The 1 Jerome, drilled by D. E. L. Byers in C SE SE 8-27n-51e, reported recovery of 4,000 ft. of oil on a 2-hour drill-stem test at 6,900-15 ft. in the Charles-Mississippian "C" zone. Location is about 6 miles southwest of the south end of Poplar field.

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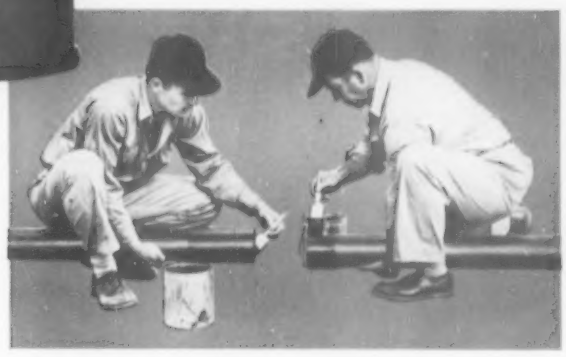

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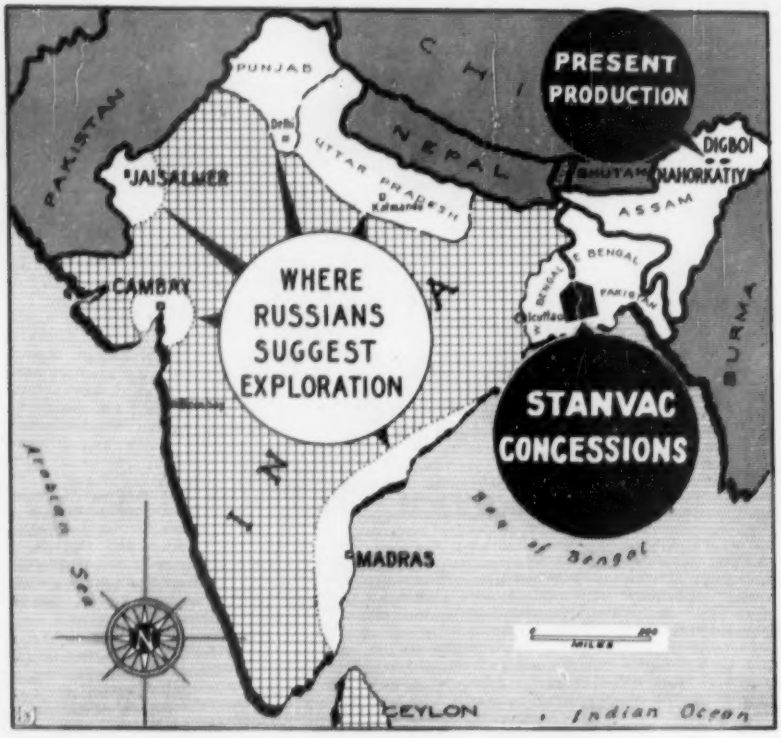

India Toughens Policy

Nation willing to permit private drillers to find oil but it wants to keep lion's share of any crude found

INDIA'S present administration is making its new oil policy clear. It wants the lion's share of any oil discovered. But it will be very happy to let private industry do most of the finding.

A growing nationalistic attitude toward oil has been apparent in India for several weeks. K. D. Malviya, the Indian minister of natural resources and scientific research, emphasized the point even more recently. He said his government's policy is to "progressively take over exploration and exploitation of oil."

At the same time, Malviya said India plans "fully enlisting private cooperation," including that of foreign experts and companies.

This policy likely will make Standard Vacuum Oil Co., the only American company with exploration acreage in India, move a bit more cautiously. It already has a Burmah Shell subsidiary in trouble, and this firm has a long operation experience in the nation.

Malviya said further that no future agreements would be made with foreign companies or individuals. The exceptions will be cases "in the national interest" or where the government gets the most favorable terms. His statements were made in the Lik Sabha (upper house) of India's Parliament in response to questions from members.

At this same session Malviya disclosed that India plans to begin its own drilling program and the government has nationalized two more privately operated industries. Malviya added the country has nationalized its diamond and copper mining industries and predicted sizable increases in production of both under government operation.

Assam Oil's position . . . The recent government moves highlight the demands India is making on Assam Oil Co., Ltd., for a 51 per cent interest in its oil operations.

This Burmah Shell subsidiary has operated in India for more than 65 years and has the country's only oil production. The Digboi field, discovered in 1890, produced India's only oil for years. It was a recent exploratory effort on the part of Assam Oil which discovered the Nahorkatiya field in 1953. The company also has done further drilling in that same area of Upper Assam where it has four small prospecting licenses.

When India granted the exploration licenses, the government planned to contribute one-third of the capital to develop the 165-sq. mile Moran license and the 280-sq. mile Hugrijan license. Under a 1954 agreement India was to have a 25 per cent interest in the two Nahorkatiya licenses covering about 64 sq. miles. The company now has 8 producing wells at its Nahorkatiya field. It and Digboi field produce about 7,200 bbl. daily, only a small fraction of India's daily demand.

Assam oil recently proposed a joint company-government company to develop all four licenses. Malviya's ministry has demanded that the government have at least 51 per cent in any such company instead of the one-third or one-quarter under the original deal. Malviya vows the government will accept nothing less than control. Negotiations to settle the controversy have bogged down completely *(The Oil and Gas Journal, March 19, page 136).*

Stanvac remains silent . . . Standard Vacuum signed an agreement with the Indian Government in 1954 calling for exploration of a 10,000-sq. mile area in the Bengal basin adjoining the India-Pakistan border. The Indian acreage is adjacent to a similar tract Stanvac has in East Pakistan.

Under terms of the agreement, India would contribute 25 per cent of the exploration costs up to $5,250,000. Details of the agreement have never been revealed. It is understood that terms provide for the usual 50-50 profit sharing in production over a definite long-term concession period. Stanvac has been carrying out surface exploration in India, but has not yet started drilling.

When recently questioned in the Indian Parliament about the time element involved in Stanvac's agreement, Malviya brushed aside queries about the length of any production agreement. He said the company is still "prospecting" and commented that the number of years involved in any production agreement would arise "if and when" oil is discovered.

Stanvac officials in this country maintain a scrupulous silence in the face of Malviya's nationalistic chest thumping. He became minister of national resources in India after the Stanvac agreement was signed.

It might be regarded as significant, however, that the rig which Stanvac re-

cently shipped from this couatry went to Pakistan for a drilling operation and not to India *(The Oil and Gas Journal, April 23, page 94)*.

India's own efforts . . . Finding indigenous oil is an urgent problem for India.

The nation is straining to switch to an industrial economy after years of agricultural poverty. Domestic production furnishes only a minute fraction of her daily petroleum needs. The gap will grow wider as new industries rise. And this means a continued drain on the nation's foreign exchange to pay for imports.

A team of Russians, identified merely as "experts" in all press reports, recently concluded a 3-month mineral survey of the country. They were invited by the Indian Government.

Reports based on this superficial survey have been turned over to the government. Apparently they are the basis for the announced decision of the resources ministry to begin a drilling operation in northern Punjab near Jawalamukhi in an area which the Russians recommended. Malviya has announced the drilling will begin before the first monsoon, or before June.

Reports from India indicate that drilling equipment purchased from Romania last month will be used on this initial well. This rig, plus services of two dozen technical people to set it up at an Indian location, is costing the government just over $930,000. This figure includes a 6-month training session for Indian personnel and a 12-month guarantee on the rig's operation.

In addition to this planned drilling operation, the government is financing geologic, seismic, and gravity meter surveys in various parts of the country. The Russian experts recommended intensive geological and geophysical investigation of Punjab, Jaisalmer, Cambay, West Bengal, Uttar Pradesh, and the Madras coastal area.

The government originally planned to spend little more than $23 million in the 1956-61 period for oil exploration in the country. Since the visit of the Russians, Malviya is asking Parliament to approve expenditures of more than $63 million for the 5-year period.

White Eagle Signs Foreign Deals

WHITE EAGLE OIL CO. of Tulsa entered the foreign exploration field on two fronts last week.

The company launched its maiden ventures outside the United States by opening offices in Cuba and the Philippine Islands, both rank wildcat countries with virtually no oil.

White Eagle, which had 1,076,969 bbl. of oil production and 5,672,687 M.c.f. of gas last year, explained its move this way: If you expect to grow substantially, you have to go abroad to virgin exploration territory.

White Eagle International Oil Co. was formed to operate in Cuba, taking over from the Perla Negra Group 4,330,000 acres in concessions scattered from one end of the Caribbean island to the other. The Philippines subsidiary is White Eagle Overseas Co., Inc., which has obtained 782,706 acres (317,202 hectares) in concessions from the government of that republic.

Walter H. Helmerich, president of the domestic company, also heads the two foreign subsidiaries.

Philippines operation . . . Marine seismic surveys are scheduled to start within 6 months on the Philippines concessions, which are in four separate parcels. They are:

. . . In the Babuyan Channel, 85,734 hectares, in the seaward extension of the Cagayan intraisland basin of northern Luzon. This block is described by White Eagle as one of the most favorable remaining in the islands.

. . . In Lingayen Gulf, 92,645 hectares off Luzon, in the seaward extension of the Central Valley intraisland basin.

. . . On Bondoc Peninsula, 99,736 hectares, in the Southeast Luzon interisland seaway, known for its many oil and gas seeps. Twenty wildcat wells, most of them shallow and none drilled to basement, were put down over a 33-year period prior to 1949 without finding commercial production.

. . . On Camote Islands and surrounding submerged lands, 39,087 hectares, selected for the relatively thin geologic section and the anticlinal folds.

Cuban deal . . . White Eagle International's concession is one of the largest in Cuba, with acreage in the provinces of Pinar del Rio, Las Villas, Camaguey, and Oriente. Forty per cent is offshore.

The concession areas were acquired from Petrolera Perla Negra de Cuba, headed by William B. Duce, Los Angeles, president, and Lincoln Valentine, Havana, vice president; and five other companies which become subsidiaries of White Eagle.

White Eagle Oil Co. put up $500,000 in cash for the Cuban subsidiary and will receive 1,000,000 shares of stock, or 20 per cent. The Cuban company plans to sell the public 1,156,250 shares at $2 a share. The O. F. Warren properties, bought recently by White Eagle Oil, will be sold to International for $1,000,000. These properties include 200 bbl. daily of crude production and 35,000 acres in mineral rights or royalties in the Williston basin.

Helmerich reported exploration commitments can be fulfilled by other companies who want to drill the acreage in return for a working interest.

Brazil Test Hits

Wildcat has poor show, but may open new coastal area

A WILDCAT drilled by Petroleo Brasileiro S.A. (Petrobras) has encountered oil and gas shows in a new area of Brazil.

The well, Testa Branca, is located 7½ miles northwest of Balsas, about 40 miles from Riachao in the State of Maranhao. Shows were encountered at depths of 4,220 and 4,240 ft.

Petrobras President Col. Janari Nunes described the well as weak and cautioned against over-optimism. But geologically, the well is important because it is the first evidence of oil and gas in Maranhao basin.

The discovery is about 1,150 miles northeast of Brazil's only producing fields at Bahia, and about 950 miles southeast of the Nova Olinda discovery in the Amazon basin *(The Oil and Gas Journal, April 11, 1955, page 95)*.

Located on an anticline with a closure of 2.7 sq. miles, Testa Branca was scheduled to go to basement expected at about 6,500 ft. Petrobras had budgeted $465,000 for the test.

Three other wells are scheduled for Maranhao basin this year. They are part of a 31-well exploration program which Petrobras has under way *(The Oil and Gas Journal, April 4, page 92)*.

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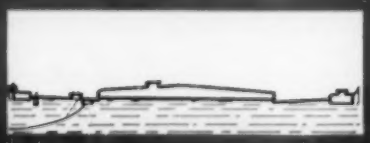

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Line May Pep Up Basin

Sinclair, Socony to spend $25 million on 211-mile, 20-in. crude line from Venezuela's Apure-Barinas area to coast

TWO companies, both with shut-in fields in the area, are going to spend an estimated $25 million on a crude-oil pipeline from the Apure-Barinas basin to Venezuela's Caribbean coast.

Neither Sinclair Oil Corp. nor Socony Mobil Oil Co. is voicing any rosy optimism about the basin. But they are the only companies with production in that region of Venezuela. The basin has been the country's surface exploration hot spot for several years.

The two companies will share construction costs on a 20-in. crude line from the basin to Puerto Cabello. The 211-mile line will have an initial capacity of 100,000 bbl. daily. The line will start at Socony Mobil Oil Co. de Venezuela's San Silvestre field.

Socony will operate the line. Sinclair's interest will be held by Sinclair Oil & Refining Co., a subsidiary of Venezuelan Petroleum Co. Sinclair owns 96.24 per cent of Venezuelan Petroleum.

A pipeline from the basin to some water-loading point has been talked by both companies for several years. The joint building plan was approved last week by the Ministry of Mines and Hydrocarbons in Caracas. Construction is expected to start in the near future.

Sinclair's field . . . It was just a year ago that Sinclair estimated it had proved reserves of at least 66,000,000 bbl. under its Barinas concession. At that time the company had four shut-in wells in the field. Now there are 10.

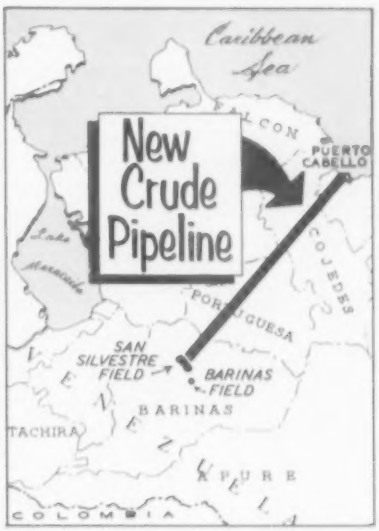
Sinclair's Barinas discovery, I Sinco, was made in May 1953 when the test was completed for about 1,300 bbl. daily of 25°-gravity crude from two productive zones found between 9,300 and 9,600 ft.

Since that time the company has developed the field on a 60-acre spacing pattern. Sinclair said last year it considers about 3,375 acres of the concession proved.

Socony's field . . . Socony Mobil's San Silvestre field and the nearby one-well Silvan field lie to the north and west of Sinclair's production.

The Socony fields are similar to Sinclair's and all have an extremely low gas-oil ratio which has posed some recovery problems for both companies.

Socony discovered the fields in 1947 and now has seven shut-in wells—six at San Silvestre and one at Silvan. The company has one rig working in the fields.



The basin probably has more open acreage than any other in Venezuela. It is one of the most sought after areas in Venezuela and parts of its open acreage are regarded as prizes when and if the government grants new exploratory concessions.

The basin is south and east of Lake Maracaibo in southwestern Venezuela. It takes in parts of the states of Apure, Barinas, Portuguesa, Cojedes, and Tachira, and extends southwest across the border into Colombia.

McCarthy Plans Gas Line

Glenn McCarthy, Houston independent, last week announced plan to build a 500-mile, 12-in., trans-Andean natural-gas pipeline from his Bolivian concession to the Chile copper mining area.

McCarthy said the project will cost from $30 to $35 million, but the financing has not yet been arranged.

The key to the entire proposal is a 20-year gas purchase contract made with Chile Exploration Co., subsidiary of Anaconda Co.

The big mining concern made it clear last week in New York that the deal it has made with McCarthy is a "purchase" contract, dependent on the noted Texan's ability to deliver the gas. The contract expires if McCarthy can't deliver gas within 4 years.

McCarthy said last week that a new subsidiary of Glenn McCarthy, Inc., Andes Pipeline Corp., will build and operate the line.

Plans now call for building the line from Villamontes to Yuni in Bolivia and then through a pass over the Andes at about 14,500 ft. to Anaconda's big Chuquicamata copper mine in Chile. It would be extended to the Chilean port city of Antofagasta.

Refinery Planned

Turkish American to build 15,000-bbl. plant at Izmit

TURKEY'S first privately owned refinery, a 15,000-bbl. daily installation, will be built at Izmit near Instanbul on the Sea of Marmara in western Turkey by a joint American-Turkish group.

A new company, Turkish American Oil Co., is being formed to own and operate the $12-million refinery. The Turkish council of ministers authorized construction last week after two Istanbul oil importers applied for the government permit. Financing is being handled by William Blair & Co., a Chicago investment firm.

A key official in the new refinery company will be Frank St. Hilaire, New York, formerly associated with Trinidad Leaseholds, Ltd., and The Texas Co. Neither of St. Hilaire's former companies is connected with Turkish American.

The new refinery's process units will include crude and vacuum distillation, catalytic cracking and catalytic polymerization. It will operate on imported crude until Turkish production can supply the plant.

Turkish American's plant plus the new 6,950-bbl. daily plant at Batman will nearly meet Turkey's domestic petroleum products demand. The Batman plant is operated by Turkish Petroleum Corp., the state-controlled company which also operates the country's only two oil fields, Raman and Garzan.

The government refinery, built by Ralph M. Parsons Co., Los Angeles, was completed several months ago. Its first 1,500 bbl. of gasoline was marketed in Iskunderun in April *(The Oil and Gas Journal, April 30, page 103).*

The new private refining capacity to be built by Turkish American will help reduce a heavy drain on Turkey's foreign exchange. The nation has long been hard pressed to buy oil and products. At the present international oil companies sell to Turkey on a cash basis only. The country owes some $40 million to Socony Mobil Oil Co., Royal Dutch-Shell, and British Petroleum Co. for oil and products shipped previously on credit.

Free-World Output Hits All-Time High

FREE-WORLD crude production continued to grow in February, rising to an all-time high level of 14,657,300 bbl. daily.

Booming industrialization in many foreign areas coupled with general winter demand accounted for an 88,000-bbl. daily increase over January. Compared with February a year ago, free-world production rose 1,101,400 bbl. daily, excluding the recently freed fields in Austria.

Record production in both the United States and the rest of the free world contributed to the high total. U. S. output was 7,208,000 bbl. daily, up 9,000 bbl. daily over the previous month and up 5.5 per cent from a year ago. The remaining non-Communist areas produced 7,449,300 bbl. daily, an increase of 79,000 bbl. daily over January and a gain of 11.9 per cent over February 1955.

Middle East . . . The Middle East had an over-all gain of 27,000 bbl. daily, raising total output to 3,419,600 bbl. daily. This level of output was a record for the area and the second new high in a row.

Most of the increase was due to Iranian crude, which continued to find a growing place in world markets. February output by the consortium was up 70,000 bbl. daily to 430,000 bbl. daily. Over the period of a year, production rose 171,000 bbl. daily, or 65 per cent.

Saudi Arabian output remained above the 1,000,000-bbl. daily mark for the fifth consecutive month. Production increased by 13,500 bbl. daily to 1,013,800 bbl. daily, up 9.8 per cent over a year ago.

These gains offset a decline of 55,000 bbl. daily in Iraq. Output there of 667,300 bbl. daily was the lowest in 8 months. Kuwait production was virtually at the same level as January. The 1,125,000-bbl. daily average was up only 200 bbl. daily.

TREND OVER THE LAST YEAR

1955—	Western Hemisphere less U. S.	Middle East	Total non-Communist countries
February	3,055.8	3,098.6	6,655.5
March	3,036.0	3,247.9	6,775.8
April	2,981.6	3,327.6	6,805.9
May	2,932.1	3,287.4	6,718.8
June	3,019.7	3,201.6	6,720.9
July	3,092.7	3,275.8	6,872.1
August	3,140.4	3,243.0	6,978.2
September	3,130.9	3,256.9	6,990.7
October	3,179.6	3,378.2	7,166.0
November	3,255.0	3,386.0	7,248.3
December	3,298.5	3,316.1	7,227.2
1956—			
January	3,365.5	3,392.6	7,370.3
February	3,417.3	3,419.6	7,449.3

Other areas . . . Venezuelan production made further gains in February as demand for heavy fuel oil continued strong in both the U. S. and Europe. The 2,352,700-bbl. daily average was a 28,200-bbl. daily increase over January and the seventh record in a row. Compared with February 1955, output has risen 202,900 bbl. daily, or 9.4 per cent.

Canadian output of 456,000 bbl. daily also was a new record. Companies increased their output by 17,200 bbl. daily over January. Over the past year, output rose 131,000 bbl. daily, a gain of 40.3 per cent.

Production increases in newly developed fields resulted in record outputs in both France and Italy.

Gains at Parentis field southwest of Bordeaux brought total French output to 23,600 bbl. daily. Parentis is operated by Esso-Rep, in which Standard Oil Co. (N. J.) has controlling interest. Increases at Ragusa field, Sicily, operated by a Gulf Oil Corp. subsidiary, raised Italian output to 8,400 bbl. daily.

In Dutch New Guinea, the three small producing fields continued to decline. Output in February averaged 7,400 bbl. daily, off 200 bbl. daily from the preceding month. Peak output in New Guinea came in September 1954 when production hit 13,500 bbl. daily.

Although New Guinea has proved a disappointment, exploration efforts to develop more production are due to continue. The Netherlands Government recently granted a new concession to Dutch New Guinea Petroleum Co. The company, which operates present fields, is owned 40 per cent by Standard-Vacuum Oil Co., 40 per cent by Royal Dutch-Shell, and 10 per cent each by Standard Oil Co. of California and The Texas Co.

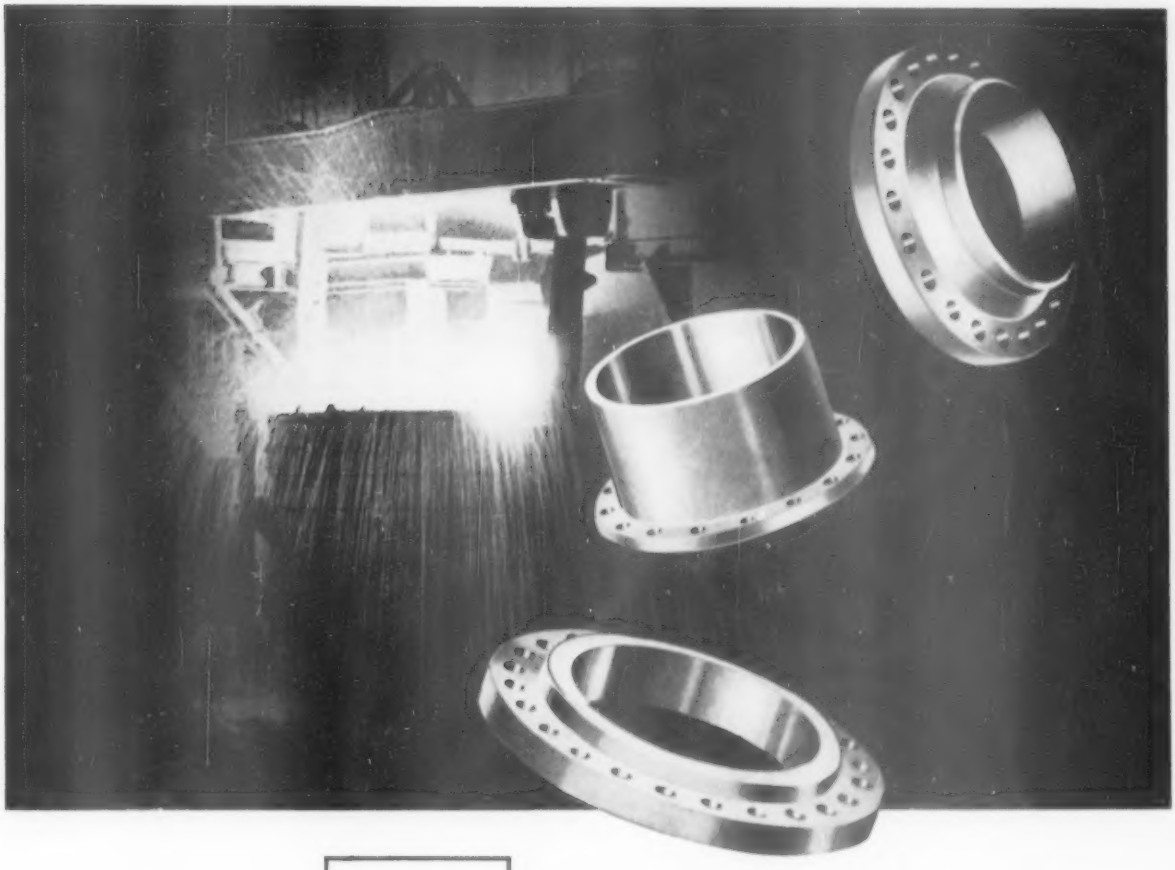
World-Wide Crude Production

(Daily average in thousands of barrels)

Country—	Feb. 1956	Jan. 1956	Feb. 1955
W. Hemisphere:			
Argentina	83.6	86.3	85.6
Bolivia	8.8	7.9	6.5
Brazil	7.0	7.0	4.8
Canada	456.0	438.8	325.0
Chile	8.8	7.3	6.0
Colombia	116.0	115.2	103.5
Cuba	1.6	1.5	0.6
Ecuador	9.9	10.0	9.6
Mexico	250.0	245.0	250.0
Peru	47.8	48.7	47.3
Trinidad	75.1	73.3	67.1
Venezuela	2,352.7	2,324.5	2,149.8
Total	3,417.3	3,365.5	3,055.8
W. Europe and Africa:			
Algeria	0.9	0.9	1.2
Austria*	65.4	65.4	
France	23.6	21.0	12.1
Fr. Morocco	2.1	2.1	2.4
West Germany	63.0	63.9	57.2
Italy	8.4	7.4	2.9
Netherlands	17.0	19.2	19.7
Egypt	36.1	35.7	33.9
United Kingdom	1.2	1.2	1.1
Yugoslavia	4.8	5.2	5.1
Turkey	5.0	5.0	2.3
Total	227.5	227.0	137.9
Middle East:			
Bahrain	30.0	30.0	30.1
Iran†	434.0	364.0	263.0
Iraq‡	667.3	722.3	662.6
Kuwait	1,125.0	1,124.8	1,086.6
Neutral Zone	30.0	30.0	19.7
Qatar	119.5	121.2	113.5
Saudi Arabia	1,013.8	1,000.3	923.1
Total	3,419.6	3,392.6	3,098.6
Other Asia:			
British Borneo	113.0	113.0	96.7
Burma	5.2	5.2	4.0
India	7.5	7.5	7.6
Indonesia	240.0	240.0	231.0
Japan	6.1	6.2	6.7
New Guinea	7.4	7.6	11.8
Pakistan	5.7	5.7	5.4
Total	384.9	385.2	363.2
Total, Free World Foreign	7,449.3	7,370.3	6,655.5
United States	7,208.0	7,199.0	6,835.0
Total, Free World	14,657.3	14,569.3	13,490.5
Communist Countries in Soviet Orbit:			
Russian Zone of Austria*			62.0
Romania	150.0	150.0	125.0
Russia	1,400.0	1,400.0	1,235.0
Others	50.0	50.0	38.6
Total	1,600.0	1,600.0	1,460.6
World total	16,257.3	16,169.3	14,951.1

*Austria took over its producing fields from Russia in August 1955. †Includes an estimated 4,000 bbl. daily from Naft-i-Shah field not operated by the consortium. ‡Includes an estimated 14,000 bbl. daily produced by British Petroleum Co., Ltd., in Naft Khaneh field.

Figures are from reliable reports in the industry or official government sources. Data for Russia and Eastern Europe are based on competent estimates; no authentic information is available on month-to-month production in these areas. Estimates also have been made for other countries, particularly in Southeast Asia, where completely current reports are lacking. Communist countries in the Soviet orbit include satellite countries in Europe and Red China.



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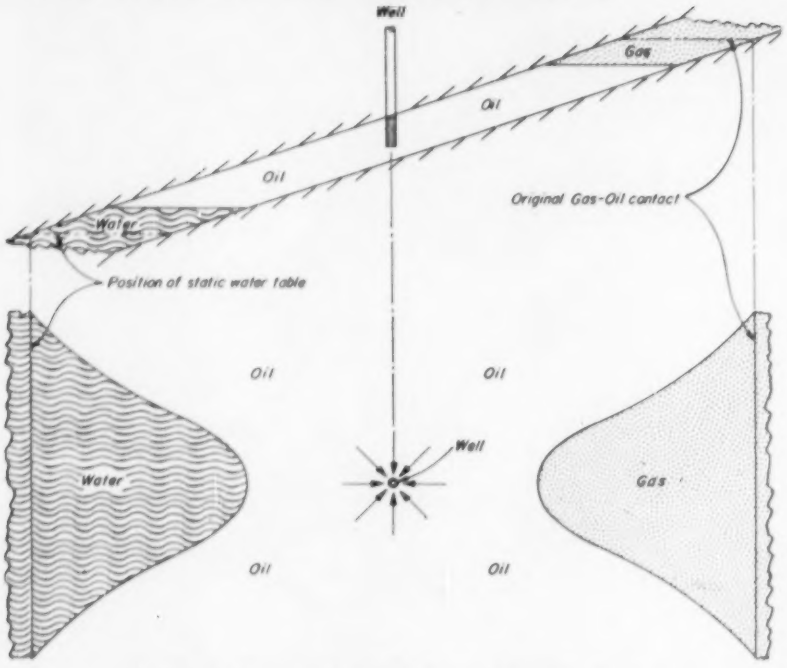
Here's the difference between "fingering" and coning"



WATER AND GAS FINGERING in an oil reservoir. Fig. 1-a.

WATER CONING in an oil reservoir. Fig. 1-b.

How to Your Well Water and

. . . and how to following

by P. E. Chaney, M. D. Noble,

PRODUCTION of water and gas-cap gas from oil wells is a common undesirable occurrence which influence the cost of oil production and the efficient depletion of the oil reservoir. Water or gas production from perforations in an oil zone, which are some distance above an oil-water contact or below gas-oil contact, is commonly referred to as either fingering or coning. Since the use of words "fingering" and "coning" is quite common and the meaning of the words is often interchanged, a distinction between the two should be made.

An examination of Fig. 1-a will give an explanation of the phenomenon of water and gas fingering while Fig. 1-b shows a diagrammatic representation of water coning. The present study is limited to water coning and does not attempt to treat the finering problem.

The maximum water-free or gas-free production rates, which will be referred to as the critical rates, shown by the curves in this report can be used easily to determine the critical production rate for a wide range of oil or gas column thicknesses with different sand permeabilities, different oil and gas viscosities and densities, and different lengths of perforated intervals placed differently within the oil sand.

If the electric-log or core-analysis information shows the sand to be reasonably homogeneous, then the information presented in this report has a number of immediate applications. A major problem easily resolved by use of the critical production-rate curves is where to perforate a thin oil column having both a gas-oil and oil-water contact, and what the initial production rate from the well should be.

Authors are with Sun Oil Co., Beaumont, Tex.

Coning

Coning of water or gas into a producing well is caused by pressure gradients established around the well bore by the production of fluid from the well. These pressure gradients tend to depress the gas-oil contact and elevate the oil-water contact in the immediate vicinity of the well. Counter-balancing these flow gradients, however, is the tendency of the gas to remain above the oil zone because of its lower density and the tendency of the water to remain below the oil zone because of its higher density. Therefore, there is a delicate balance created between two forces—the pressure gradients causing fluid flow and the gravitational force due to the density of differences between oil, water, and gas.

Actually, these forces will cause a cone to form above or below the well for any production rate. However, the well does not start producing water or gas until the pressure gradients become large enough to overcome the gravitational forces. When the pressure gradients exceed the gravitational forces the water or gas below or above the well bore can no longer remain as a stable cone and starts to flow into the well bore.

How it's predicted . . . From the preceding discussion it is apparent that predicating the maximum water or gas-free oil-production rate (critical production rate) necessitates calculating what production rate results in pressure gradients large enough to overcome the gravitational forces. Calculation of the pressure gradients around the well bore presents an extremely complex problem —the geometry of the reservoir system (sand thickness, interval of sand perforated, position of perforated interval, and drainage radius) and the characteristics of the reservoir fluids and sand (viscosity, density, and permeability). The well-bore diameter and the perforations have been found to have essentially no effect on the rate at which

PRODUCING

Perforate to Prevent Gas Coning

produce the well perforation

W. L. Henson and J. D. Rice

water or gas will come into the well bore.

Of the two major criteria mentioned the effect of the geometry on the gradient is the most difficult to isolate. The Potensiometric Aanalyzer provided a ready solution to this problem. Mathematical equations were developed such that when the gradient was determined for a particular geometric system, it could be transformed to the gradient for systems with similar geometrics. Thus the Potentiometric Analyzer and the mathematical equations together offered a ready means of obtaining the critical production rates for various geometric systems. Once the critical production rate has been determined for a system of given geometry and assumed reservoir fluid and sand characteristics, this rate can be easily corrected for other values of fluid and sand characteristics as long as the geometry remains the same.

Critical Production Rate

Critical production rate curves, shown on Figs. 2 through 6, were obtained from both mathematical and potentiometric analyzer analyses. The mathematical derivation is available from the authors on request.

The curves show critical production rates in reservoir barrels per day versus the distance of the top of the perforated interval from the top of the sand or gas-oil contact. Curves are shown for sand thicknesses of 12.5, 25, 50, 75 and 100 ft. having drainage radii of 1,000 ft. It should be emphasized that the term "sand thickness" refers to the actual oil column thickness or, in the case of a gas reservoir, the actual gas column thickness.

A comparable set of critical production rates were calculated for a drainage radius of 500 ft. Rates for the 500-ft. drainage radius ranged from 10 to 15 per cent higher than those for the 1,000-ft. radius. The 10 to 15 per cent figure varies according to the sand thickness and the location of the perforations within the sand.

Correcting curves . . . The critical production rates shown on Figs. 2 through 6 were calculated using the following assumed fluid and sand characteristics:

Permeability = 1,000 md.
Viscosity of oil = 1 cp.
Density difference between oil and water = 0.3 g. per cc.
Density difference between oil and gas = 0.6 g. per cc.

Therefore to use a rate obtained from these curves, it must be corrected for the actual values of the fluid and sand characteristics and also must be corrected to surface units. These corrections are taken into account by the following equations:

Equation 1—Water-coning rates in on oil-water system:

$$Q_o = \frac{0.00333\ K_v\ (\Delta\gamma_{o,w})\ Q\ \text{curve}}{\mu_o\ B}$$

in stock-tank barrels per day.

Equation 2—Water-coning rates in a gas-water system:

$$Q_g = \frac{0.00333\ K_v\ (\Delta\gamma_{g,w})\ Q\ \text{curve}}{\mu_g\ V}$$

in standard M.c.f. per day.

Equation 3—Gas-coning rates in an oil-gas system:

$$Q_o = \frac{0.00167\ K_v\ (\Delta\gamma_{o,g})\ Q\ \text{curve}}{\mu_o\ B}$$

in stock-tank barrels per day.

Conclusions reached from this investigation . . .

THIS article presents the results of a mathematical analysis and potentiometric analyzer study of water and gas coning. From the analysis, a set of curves has been developed by which maximum water-free or gas-free oil production rates can be determined for wells having a gas-oil contact, water-oil contact, or both. The following main conclusions were obtained:

1. The perforations in a well having only a slight contact should be placed as far from the contact as possible in order to obtain the maximum water-free or gas-free production rate.

2. There is an optimum position to perforate a sand having both gas-oil and oil-water contacts. Perforating the sand in the optimum position will allow the greatest water-free and gas-free production rate possible.

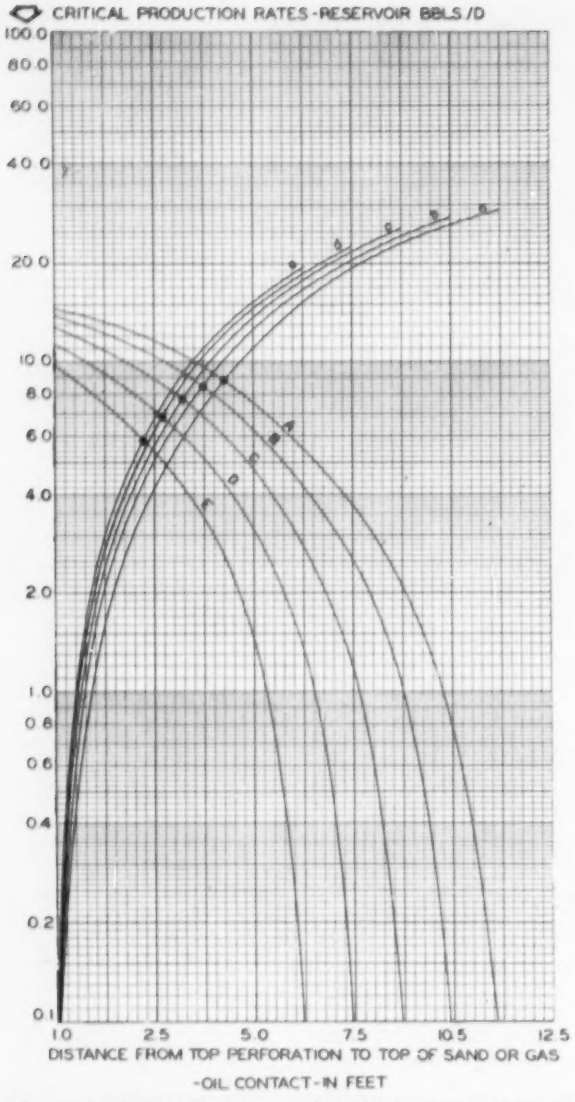
3. The optimum position to perforate a homogeneous sand having gas-oil and oil-water contacts is obtained by placing the perforations such that the distance from the gas-oil contact to the middle of the perforated interval is equal to 35 to 45 per cent of the total oil-column thickness.

4. The smaller the perforated interval, the greater the water-free and gas-free production rates which may be sustained. However, perforating less than 10 per cent of the total oil column thickness results in very little additional increase in the critical production rate. There is also the possibility that perforated intervals less than 10 per cent of the total oil-column thickness would limit the productive capacity of the well to an extent that would prohibit the well from producing the critical production rate shown on the curves.

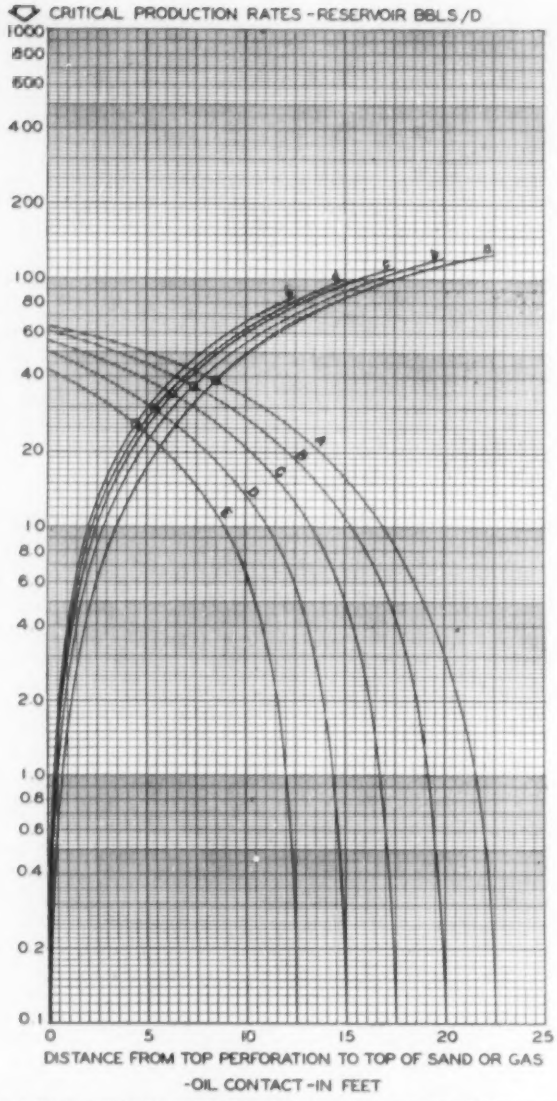
5. Any impervious barrier, such as a shale break, between the bottom perforation and the water-oil contact or between the top perforation and the gas-oil contact will allow the well to produce at much greater water or gas-free production rates than those shown on the curves. This barrier, which acts as a shield in retarding the tendency of gas or water to come into the well bore, does not have to extend any great distance away from the well bore.

6. Once either gas or water coning has occurred due to excessive production, it should be possible to shut the well in, allow the contacts to restabilize, and then open it up at a lesser production rate without the recurrence of coning. The lesser rate is required because the effective permeability to gas or water has been increased and coning will occur more easily. The vertical permeability must be such that gravity segregation will allow rapid reduction of the water or gas saturation below or above the well bore, otherwise, shutting in the well would prove unsatisfactory.

7. Greater production rates than those shown by the curves can be obtained by wells where the oil sand has a horizontal permeability greater than the vertical permeability because the lesser vertical permeability acts to a very small degree the same as an impervious barrier.



CRITICAL-PRODUCTION-RATE CURVES for sand thickness of 12.5 ft., well radius of 3-in., and drainage radius of 1,000 ft. Water coning curves: A, 1.25 ft. perforated interval; B, 2.5 ft.; C, 3.75 ft.; D, 5.00 ft.; and E, 6.25 ft. Gas coning curves: a, 1.25 ft. perforated interval; b, 2.5 ft.; c, 3.75 ft.; d, 5.00 ft., and e, 6.25 ft. Fig. 2.



CRITICAL-PRODUCTION-RATE CURVES for sand thickness of 25 ft., well radius of 3 in., and drainage radius of 1,000 ft. Water coning curves: A, 2.5 ft. perforated interval; B, 5 ft.; C, 7.5 ft.; D, 10 ft.; and E, 12.5 ft. Gas coning curves: a, 2.5 ft. perforated interval; b, 5 ft.; c, 7.5 ft.; d, 10 ft.; and e, 12.5 ft. Fig. 3.

where:

K_o = specific permeability of the sand to oil or gas, md.

μ_o = viscosity of the oil, cp.

μ_g = viscosity of the gas, cp.

$\Delta\gamma_{o,w}$ = density difference in g. per cc., between the oil and water

$\Delta\gamma_{o,g}$ = density difference in g. per cc. between the oil and gas

$\Delta\gamma_{g,w}$ = density difference in g. per cc. between the gas and water

B = formation volume factor which converts reservoir units to stock tank units and may be read from B curves

V = reservoir barrels occupied by 1 standard M.c.f. of gas as read from V curves

Q curve = critical production rate in reservoir barrels per day read from curves in Figs. 2 through 6

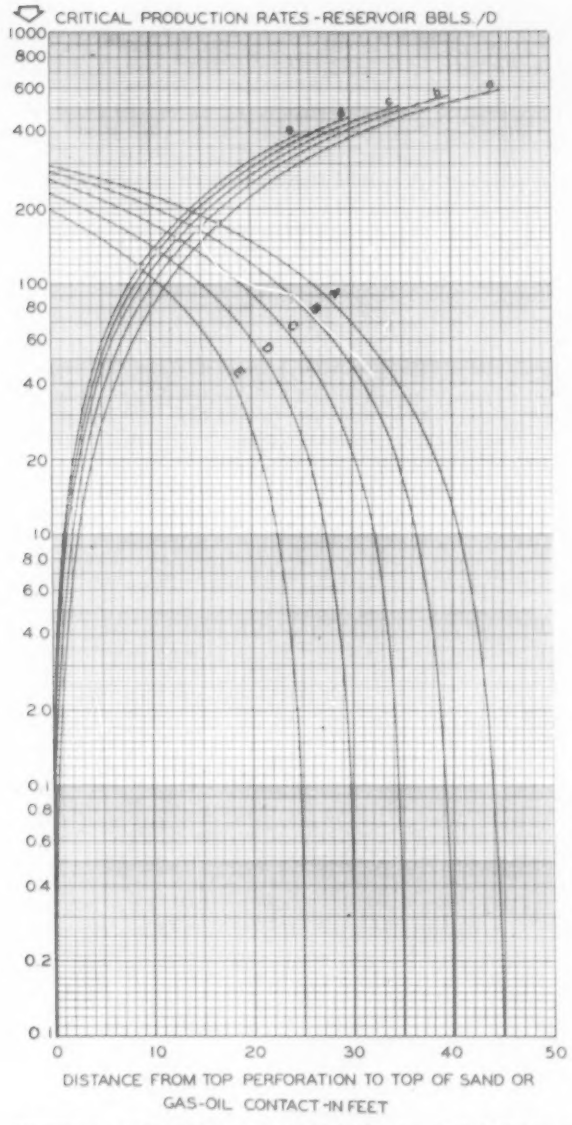
Q_c = corrected critical production rate for well in question

As an example, take the case of a 50-ft. oil column having only a water-oil contact in the well and which has the middle 10 ft. of sand perforated. This would place the top perforation 20 ft. below the top of the sand. Referring to curve B on Fig. 4, it is seen that the maximum uncorrected water-free rate of production from this well would be 122 reservoir barrels per day. This value would then be entered into Equation 1, together with the correct values for permeability, viscosity, etc., to obtain the corrected maximum water-free production rate for this well.

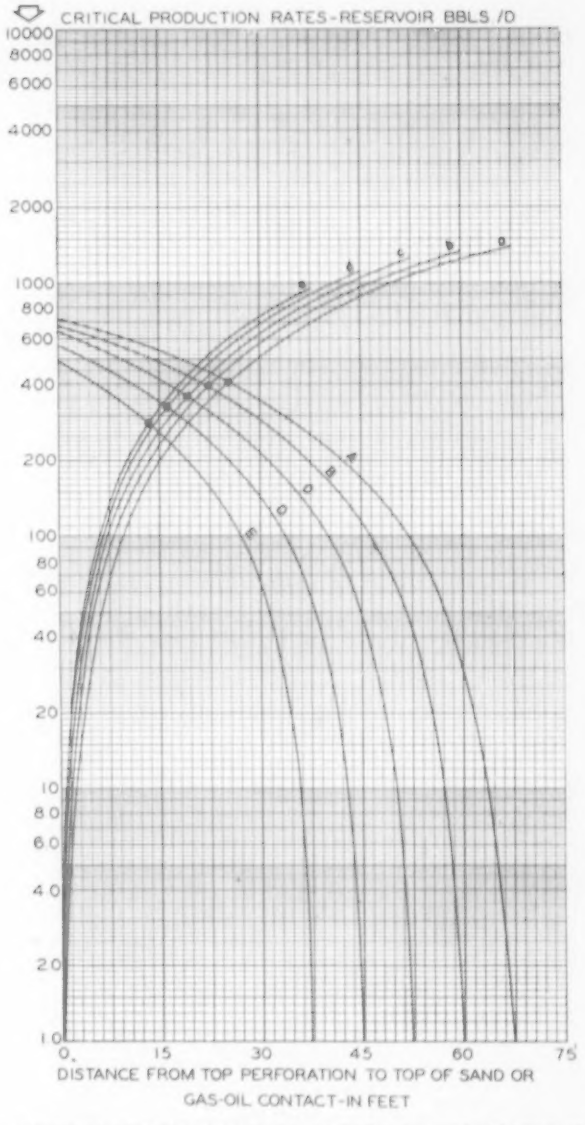
If this well had a gas-oil contact and no oil-water contact, the uncorrected maximum gas-free oil production rate would be 250 reservoir barrels per day as read from curve b on Fig. 4. This value would be substituted in Equation 3 to obtain the correct production rate.

Where to perforate . . . Another very important problem that the water and gas-coning curves help resolve is where to perforate a thin oil column which has a water-oil and gas-oil contact to obtain the maximum water-free and gas-free oil production rate.

As an example, take the case where it is desired to perforate 10 ft. of a



CRITICAL-PRODUCTION-RATE CURVES for sand thickness of 50 ft., well radius of 3 in., and drainage radius of 1,000 ft. Water coning curves: A, 5 ft. perforated interval; B, 10 ft.; C, 15 ft.; D, 20 ft.; and E, 25 ft. Gas coning curves: a, 5 ft. perforated interval; b, 10 ft.; c, 15 ft.; d, 20 ft.; and e, 25 ft. Fig. 4.



CRITICAL-PRODUCTION-RATE CURVES for sand thickness of 75 ft., well radius of 3 in., and drainage radius of 1,000 ft. Water coning curves: A, 7.5 ft. perforated interval; B, 15 ft.; C, 22.5 ft.; D, 30 ft.; and E, 37.5 ft. Gas coning curves: a, 7.5 ft. perforated interval; b, 15 ft.; c, 22.5 ft.; d, 30 ft., and e, 37.5 ft. Fig. 5.

50-ft. oil column, having gas-oil and oil-water contacts. Fig. 4 shows that if the top perforation is placed 10 ft. below the gas-oil contact, it would take a production rate of 205 reservoir barrels per day to cause water coning, whereas it would be possible to produce at only 97 reservoir barrels per day without coning gas.

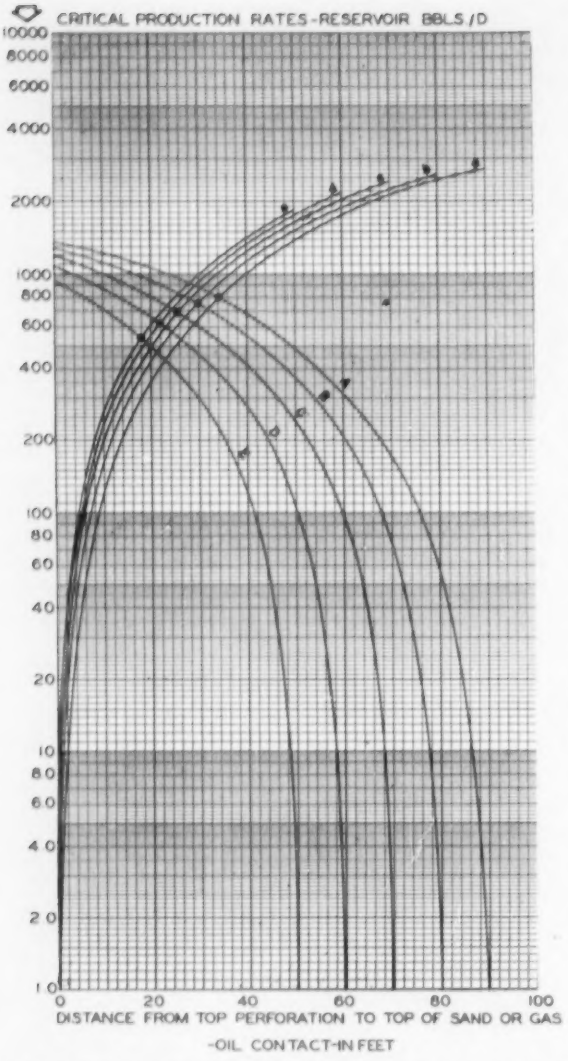
The point of intersection of the gas and water-coning curves automatically gives the maximum production rate at which the well can be produced without either water or gas coning. The point of intersection also establishes where the perforation should be placed. For the 10-ft. perforated interval, the intersection of curves B and b indicates that placing the top perforation 14.7 ft. below the gas-oil contact would provide the maximum production rate without either water or gas coning.

However, it must be remembered that these curves were compiled on the basis of a density difference between oil and water of 0.3 g. per cc. and a density difference between oil and gas of 0.6 g. per cc. The point of intersection of the water and gas-coning curves will not be the same for density differences other than those mentioned. If the density differences between the oil, water, and gas in the problem just discussed were different from those on which the curves are based, the procedure to find the new point of intersection would be as follows:

1. Pick three points on curve b, Fig. 4, which is the gas-coning curve. The three points should consist of the intersection point, and points 10 per cent to 15 per cent of the total sand thickness on either side of the intersection point. For the 50-ft. sand, the points would be 10, 14.7, and 20 ft. from the top perforation to the gas-oil contact.

2. Substitute the critical production rate at each of these points into Equation 3, and determine the corrected critical production rate in stock-tank barrels.

3. Plot the corrected critical production rates versus the distance from top



CRITICAL-PRODUCTION-RATE CURVES for sand thickness of 100 ft., well radius of 3 in., and drainage radius of 1,000 ft. Water coning curves: A, 10 ft. perforated interval; B, 20 ft.; C, 30 ft.; D, 40 ft.; and E, 50 ft. Gas coning curves: a, 10 ft. perforated interval; b, 20 ft.; c, 30 ft.; d, 40 ft.; and e, 50 ft. Fig. 6.

perforation to gas-oil contact on semi-log paper. The resultant curve should be similar in shape to curve b on Fig. 4.

4. Pick the critical production rates from curve B, the water-coning curve, at the same three points referred to in Step 1.

5. Substitute those values in Equation 1, and determine the corrected critical production rates in stock-tank barrels.

6. Plot the corrected critical production rates on the same graph referred to in Step 3. The intersection of these two curves will give the corrected maximum water-free and gas-free oil-production rate in stock-tank barrels. The intersection point also shows where in the sand the top perforation should be placed.

Perforating interval. It is of interest also to notice that the intersection of the water and gas-coning curves indicates that smaller perforated intervals should be used where both gas-oil and water-oil contacts exist. Examination of the curves indicates that increases in the maximum critical oil-production rates can be realized by perforating smaller intervals of sand up to a minimum of about 10 per cent of the total sand thickness.

On any of Figs. 2 through 6 it can be seen that a curve drawn through the intersection points of the water and gas-coning curves for the different perforated intervals will define the increase in critical production rate that may be obtained by decreasing the length of the interval perforated. It is noticed that this curve would be almost flat for perforated intervals smaller than 10 per cent of the total oil or gas-column thickness.

The critical production rates shown on the water and gas-coning curves should not be construed to indicate the productive capacity of a well. It is possible that a well may not have the productive capacity to produce at the critical production rate determined from the curves. This is due to the fact that the critical production rates are not sensitive to the pressure drawdown in the immediate vicinity of the well bore and, consequently, are not affected by skin effects. Also the critical rates are not affected greatly by the absolute value of the reservoir pressure. However, the productive capacity of a well is limited by the degree of available pressure drawdown and the amount of this drawndown necessary to overcome any skin effects that might exist.

There is no exact quantitative method for determining the productive capacity of a well prior to the initial test. It is possible, however, to make qualitative estimates which contain a sufficient margin of safety to insure that enough of the well bore will be perforated to obtain the maximum desired production rate. The curves in Fig. 7 show the maximum pressure drop required to produce at a given rate for various perforated intervals in a 6-in.-diameter cased well bore with a perforation density of four ¼-in.-radius perforations per foot. The curves in Fig. 7 were calculated on the basis of a permeability of 1 darcy and a viscosity of 1 cp. Therefore, the pressure drop read from the curves must be corrected by dividing by the correct permeability in darcies and multiplying by the correct viscosity in centipoises.

The curves in Fig. 7 do not consider skin effects, such as plugged perforations or contamination of the sand face by the mud filtrate, etc. Therefore, in order to provide a margin of safety for unknown skin effects, it is suggested that if the corrected pressure drawdown from Fig. 7 exceeds one-half of the available pressure drop (hereafter referred to as the working-pressure drop), then a larger interval of sand should be perforated. The available pressure drop is equal to the shut-in bottom-hole pressure minus the pressure exerted by the weight of the fluid in the tubing.

It should be emphasized that the curves in Fig. 7 and subsequent procedure for estimating the productive capacity are presented as a guide. Field experience gained from operations in a given area might provide better criteria for estimating the initial productive capacity of a well.

Application to Field Cases

A complete illustration of the use of Figs. 2 through 6 and Fig. 7, along with the equations and necessary corrections, is given in the following sample calculations:

I. State Lease 1337, Well 9, Bateman Lake field, Louisiana.

See Fig. 8a for electric log.

Given data:

Depth = 12,118 to 12,134 ft.
Oil-column thickness = 16 ft.
Drainage radius = 1,000 ft.
Perforations = top 5 ft.
Viscosity = 0.3 cp.
Density of salt water = 1.1 g. per cc.
Density of oil = 0.62 g. per cc.
Density difference between oil and water = 0.48 g. per cc.
Permeability = 1,500 md.
F.V.F. = 1.4.

To determine the critical production

rate for a well and to find if the well is capable of producing the critical production rate, the steps to be taken are as follows:

1. Find the critical production rate from curves and correct for actual fluid properties and sand permeability. Interpolation of the curves must be used for sand thicknesses and perforated intervals not given in this report.

2. Calculate available pressure drop at the well bore.

3. Determine if the well is capable of producing the critical production rate.

The detailed procedure for taking these steps is as follows:

1. Calculation of Critical Production Rate.

Notice that no curves are given for a 16-ft. sand thickness. Therefore, to obtain a value for the critical production rate, interpolation must be used. Straight-line interpolation is considered to be sufficiently accurate.

First obtain the per cent perforation with respect to the total oil-sand thickness.

(5 ft. perforated)/(16 ft. of oil sand) $\times$ 100 = 31.25 per cent.

Look at the curves for a 12.5-ft. oil sand thickness on Fig. 2. Notice that the perforated interval lengths are in multiples of 10 per cent of the total sand thickness. Since there is no curve for a 31.25 per cent perforated interval, straight-line interpolation will be used here also.

For the 12.5-ft. sand the critical production rate for a 30 per cent interval is 12.7 bbl. per day. The critical production rate for a 40 per cent interval is 11.25 bbl. per day.

Then:

$$12.7 - 0.125\ (12.7 - 11.25)$$

$$= 12.5 \text{ bbl. per day}$$

which is the critical production rate for a 12.5-ft. sand with a 31.25 per cent perforated interval.

For the 25-ft. sand, the critical rate for a 30 per cent interval is 56 bbl. per day, and the critical rate for a 40 per cent interval is 50 bbl. per day.

Then $56 - 0.125\ (56 - 50) = 55.3$ bbl. per day which is the critical production rate for a 25-ft. sand with a 31.25 per cent perforated interval.

Using the above two calculated rates the critical rate for the 16-ft. sand with the top 31.25 per cent perforated is:

$$12.5 + (55.3 - 12.5)\frac{(16 - 12.5 \text{ ft.})}{(25 - 12.5 \text{ ft.})}$$

$$= 24.5 \text{ bbl. per day}$$

The critical production rate thus far obtained has not been corrected for the true permeability, viscosity, and density difference, nor has it been corrected to surface units. Substituting the given data and the above critical rate in Equation 1 gives:

$$Q_c = \frac{(0.003333)\ (1,500)\ (0.48)\ (24.5)}{(0.3)\ (1.4)}$$

$$= 140 \text{ stock-tank barrels per day}$$

which is the rate at which this well should be able to produce without coning water. When initially flowed, this well produced pipeline oil at the rate of 216 stock-tank barrels per day. However, after 12 hours, the well started producing water. To insure that the water production was not due to mechanical defects nor to a bad cement job, the well was shut in and recemented. After resuming production, salt water was still produced with an increasing per cent water cut until approximately 1 month later the well was producing 114 bbl. of oil per day with 85 per cent salt water.

2. Calculation of Available Pressure Drop.

The depth is taken to the middle of the perforated interval which is 12,120.5 ft. The reservoir is at original pressure and assuming the tubing to be completely filled with oil, then:

0.4615 psi. per foot is the salt-water gradient, 0.434 psi. per foot is the fresh-water gradient.

The oil gradient is: (0.434) (0.62) = 0.2691 psi. per foot.

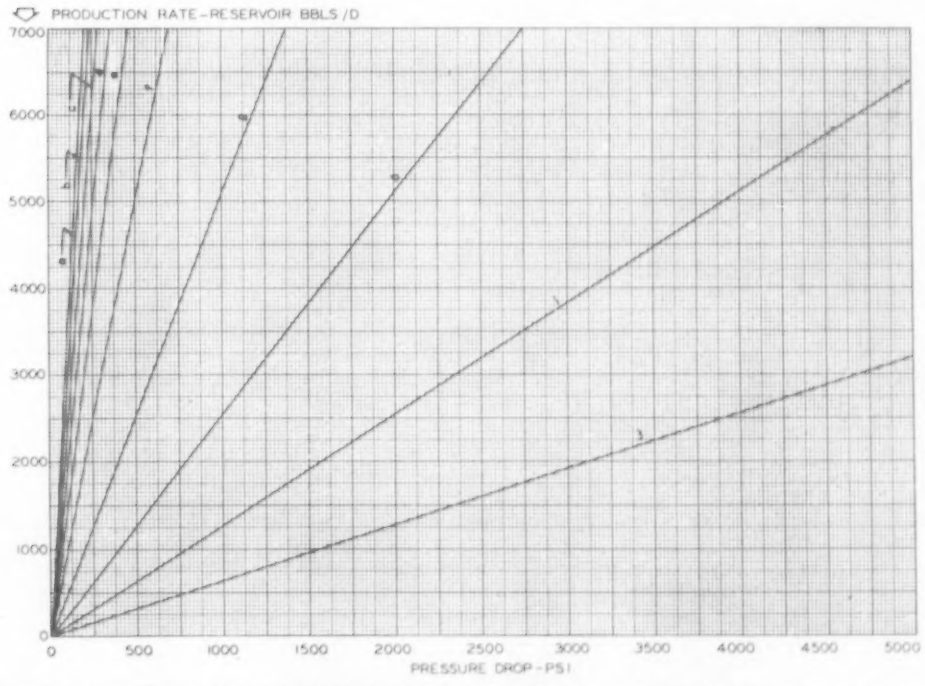
Then the available pressure drop is (0.4615 — 0.2691) $\times$ 12,120.5 = 2,332 psi.

The available drop should be divided by two in order to obtain the working pressure drop. This is a safety factor which takes into account any skin effects near the well bore that might cause an increase in pressure drop for a given production rate. Therefore:

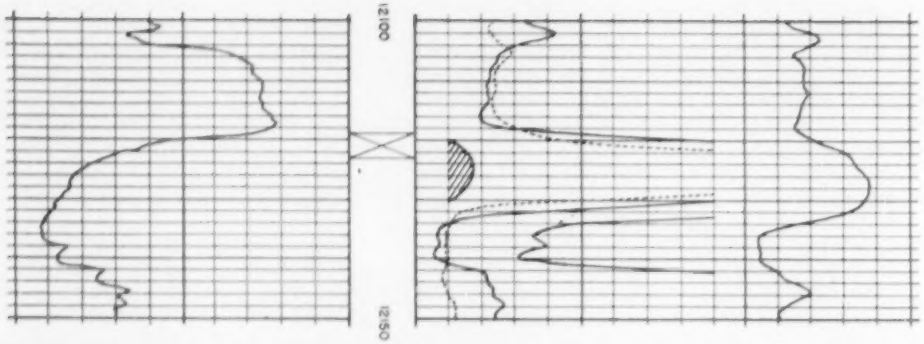
Working pressure drop = (available pressure drop)/2 = 2,332/2 = 1,166 psi.

3. Determination of Capability of Well.

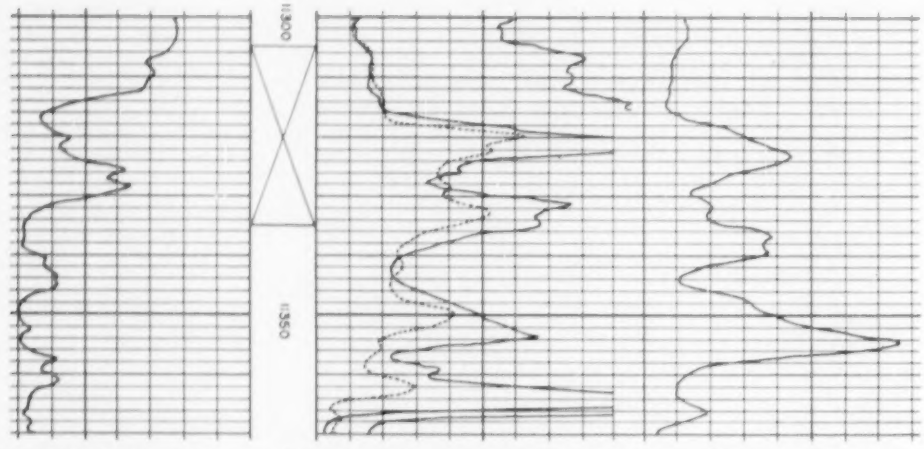
The critical production rate for this well has been found to be 140 stock-tank barrels per day. Multiplying by the formation volume factor gives 196



PRODUCTION RATE VERSUS REQUIRED PRESSURE DROP where the effective well radius is due to a perforation density of four ¼-in.-radius perforations per foot. Drainage radius, 1,000 ft.; well radius, 0.25 ft.; effective well radius, 0.000932 ft. Perforated interval curves: a, 70 ft.; b, 60 ft.; c, 50 ft.; d, 40 ft.; e, 30 ft.; f, 20 ft.; g, 10 ft.; h, 5 ft.; i, 2½ ft., and j, 1.25 ft. Fig. 7.



ELECTRIC LOG for well No. 9, State Lease 1,337; Bateman Lake field, Louisiana. Potential test: Perforation interval, 12,119 to 12,123 ft. with 16 shots; 216 bbl. per day, 7/64-in. choke; total pressure, 1,750 psi.; gas-oil ratio 800 to 1. Fig. 8-a.



ELECTRIC LOG, well No. A-1, State Lease 1537, Eugene Island field, Louisiana. Initial potential: Perforation interval 11,305 to 11,335 ft. with 117 shots; 2.5 M.M.c.f. gas per day; 10/64-in. choke; total pressure, 4,225 lb. Fig. 8-b.

reservoir barrels per day. Referring to Fig. 7, it is seen that approximately 85 psi. pressure drop is required to produce 196 reservoir barrels per day. Since the pressure drop is based on a permeability-viscosity ratio of one, it must be corrected for the actual permeability and viscosity. This correction is as follows:

Corrected pressure drop = (pressure drop from curve) (actual viscosity)/(actual permeability) = (84) (0.3)/1.5 = 17 psi.

Since only 17 psi. pressure drop is required and 1,166 psi. drop is available, the well is certainly capable of producing the critical production rate.

II. State Lease 1537, Well A-1, Eugene Island area, Louisiana.

See Fig. 8b for electric log.

Given data:

Depth = 11,305 to 11,366 ft.
Original pressure = 5,225 psi.
Gas column thickness = 61 ft.
Drainage radius = 1,000 ft.
Perforation = top 30 ft.
Density of salt water = 1.1 g. per cc.
Density of gas = 0.279 g. per cc.
Density difference between gas and water = 0.821 g. per cc.
Viscosity of gas = 0.025 cp.
Permeability = 200 md.
Reservoir barrels occupied by 1,000 standard cubic feet of gas (V) = 0.68.

The steps to be taken are the same as those outlined in Example I.

1. Calculation of the Critical Production Rate.

It is noticed that no production rate curves are given for a 61-ft. sand. Hence, the critical production rate will be obtained again by straight-line interpolation.

First obtain the per cent perforation with respect to the total oil sand thickness (49.18 per cent).

From Fig. 4 find critical rates for 40 and 50 per cent perforated interval of 50-ft. sand (229 and 198 bbl. per day). Interpolate for rate for 49.18 per cent perforations (200.5 bbl. per day). Do the same for 75-ft. sand using Fig. 5. Find interpolated critical rate (495.7 bbl. per day). Interpolate between rates for 50 and 75-ft. sands and find rate for 61-ft. sand (330 bbl. per day).

Now correct the critical rate for the reservoir and fluid characteristics using the given data and Equation 3. (Corrected rate is 10,624 M.c.f. per day.)

2. Calculation of Working Pressure Drop.

State Tract 1537, Well A-1, was the first well in the reservoir; therefore, the closed-in bottom-hole pressure is equal to the original pressure. The tubing is assumed to be full of gas. Depth is taken to middle of perforated interval which is 11,320 ft.

The fresh-water gradient is 0.434 psi. per foot and the salt water gradient is 0.4615 psi. per foot.

The gas gradient is (0.434) (density of gas) or (0.434) (0.279) or 0.1211 psi. per foot.

Then the working-pressure drop at the well bore, including the safety factor of two for skin effects is:

(0.4615 − 0.1211) (11,320/2) or 1,927 psi.

3. Determination of Capability of Well.

For a V factor of 0.68 reservoir barrel per M.c.f. the critical production rate of 10,624 M.c.f. per day is equivalent to 7,224 reservoir barrels per day. Referring to Fig. 7, approximately 475 psi. is required to produce 7,224 reservoir barrels per day. Correction for actual permeability and viscosity is as follows:

Corrected pressure drop = (pressure drop from curve) (actual viscosity)/(actual permeability, darcies) = (475 psi.) (0.025)/(0.200) = 59.5 psi.

Since only 59.5 psi. pressure drop is required and 1,927 psi. drop is available, the well is certainly capable of producing the critical production rate.

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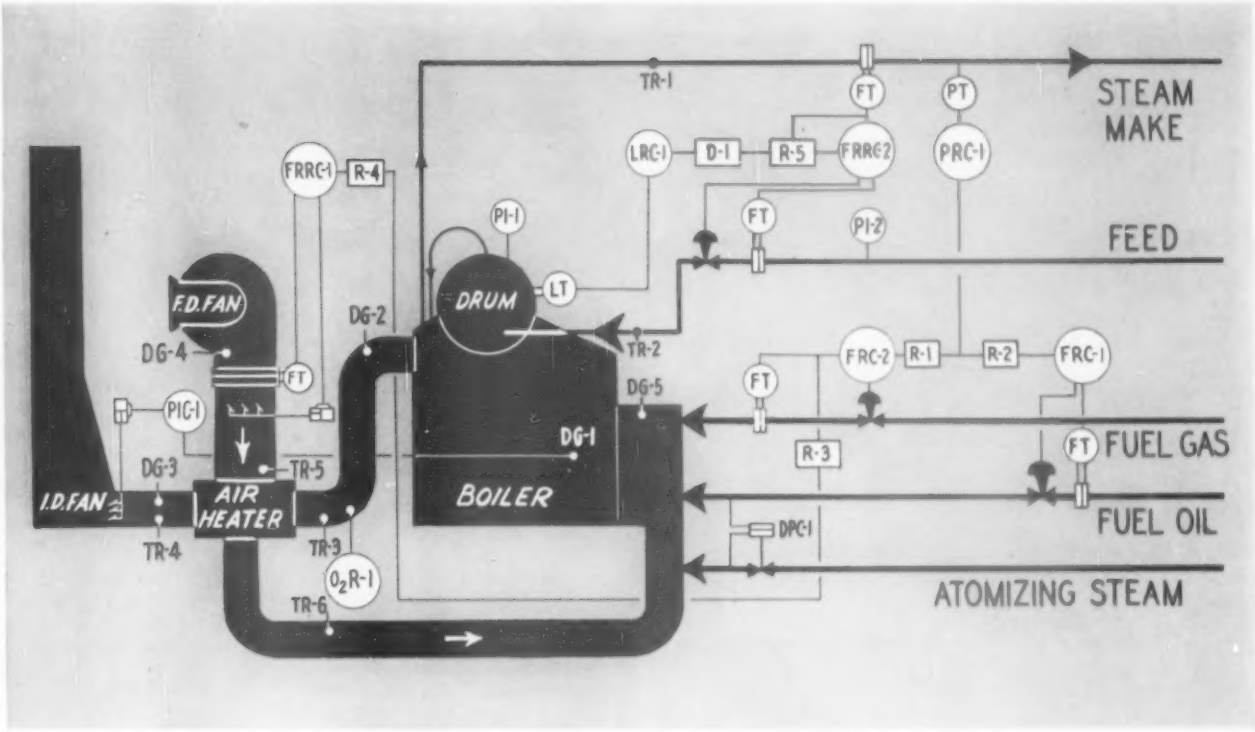


INSTRUMENTATION SCHEME for oil and gas-fired boiler. Fig. 1.

LEGEND

FT—Flow transmitter
FRC-1—Flow recorder controller
FRC-2—Flow recorder controller
PT—Pressure transmitter
PRC-1—Pressure controller—master steam
LT—Level transmitter
LRC-1—Level recorder controller
FRRC-1—Flow ratio recorder-controller—air to fuel
FRRC-2—Flow ratio recorder-controller—feed water to steam
PI-1—Pressure indicator—steam drum
PI-2—Pressure indicator—feed water
PIC-1—Pressure indicating-controller—furnace pressure
TR—Multipoint temperature recorder
TR-1—Steam
TR-2—Feed water
TR-3—Flue gas, air heater inlet
TR-4—Flue gas, air heater outlet
TR-5—Air, heater inlet
TR-6—Air, heater outlet
DG—Multipoint draft gage
DG-1—Furnace
DG-2—Boiler outlet
DG-3—Air heater outlet
DG-4—Forced-draft fan discharge
DG-5—Windbox
O$_2$R—Oxygen recorder
DPC-1—Differential pressure controller—self-acting
R-1—Ratio relay
R-2—Ratio relay
R-3—Totalizing relay
R-4—Ratio relay
R-5—Pneumatic set ratio relay
D-1—Adjustable restrictor

How to Instrument Refinery Boilers

Steam plants are borrowing ideas and adapting instruments that are used in process plants, to the end of improved performance and reduced inventories

by Robert Silva

INSTRUMENTATION to measure and control those variables encountered in process plants will measure and control, equally well, similar variables in industrial steam plants. Today there is a definite trend toward "process-type" instruments in process steam plants, and it is a natural sequence.

Instruments for process measurement and control are necessarily more highly developed, dynamically, than the usual power-plant instruments. They are more compact dimensionally, and require less space on central control panels.

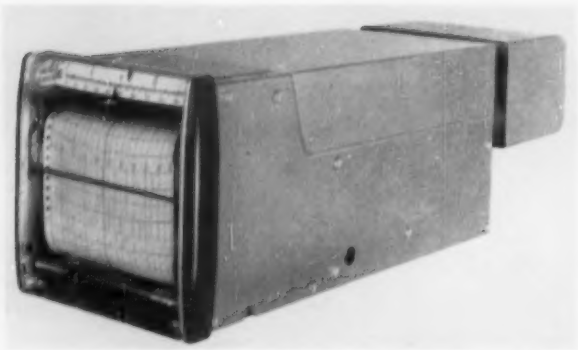
Because they operate successfully even under severe industrial conditions they are dependable in a steam plant. The plant instrument department already familiar with the process instruments can maintain similar instruments in the boiler house with reduced inventories of parts and supplies; and usually they cost less.

Author is with Refinery Industries Division, Foxboro Co., Foxboro, Mass.

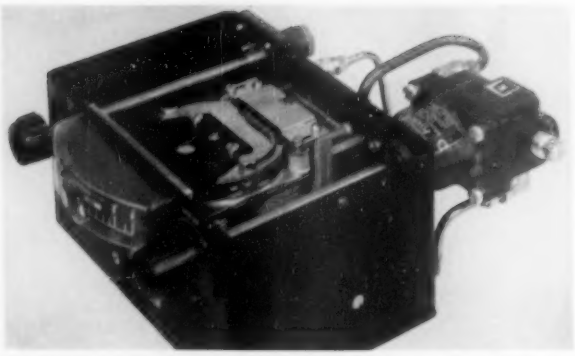
REFINING

Typical Installation

Fig. 1 shows a boiler instrumentation system to hold the main steam header



CONTROL STATIONS are centrally located and pneumatic transmission of instruments is used. Fig. 2.



RATIO RELAY is used to proportion the fuel-oil and fuel-gas flows according to their availability. Fig. 3.

pressure within narrow limits, and to provide safe and economical boiler operation.

Pneumatic control instruments are used to control steam header pressure, fuel oil-fuel gas flow ratios, air-fuel flow ratio, furnace pressure, and boiler-drum level. Consistent with process-plant practice, pneumatic transmission of measurements is used in conjunction with centrally located receiver control stations similar to that shown in Fig. 2.

Monitoring instruments are used to indicate or record important variables such as feed-water pressure, steam-drum pressure, furnace pressures, and plant temperatures. For better operating supervision, all measurement and control information and all operating stations and warning signals are mounted on a central instrument panel.

Although details of instrument design and operation are important factors in boiler-plant instrumentation, the control system as such is of more general interest.

Master pressure control . . . Steam header pressure is measured and transmitted to the master steam-pressure controller and the output air pressure from this controller establishes the control point setting of the fuel-oil and fuel-gas flow controllers, FRC-1 and FRC-2. If the steam pressure drops below the set value the fuel flow is increased. Air-flow and fuel-flow control systems are interconnected to adjust air flow automatically with changes in fuel flow.

Fuel-flow control . . . In the fuel-flow control system the operator can proportion the fuel-oil and fuel-gas flows according to their availability by adjusting the setting levers on the ratio relays R-1 and R-2 (example of ratio relay shown in Fig. 3). Fuel-gas flow is measured and transmitted to FRC-2. Fuel-oil flow is measured and transmitted to FRC-1.

In operation the output air pressure signal from the master steam pressure controller increases or decreases the fuel flows in the same proportions as established by the setting levers on the relays R-1 and R-2. The range of ratio settings is governed by the rangeability of the associated flow-measuring instruments.

Air-fuel ratio . . . The control point—primary flow measurement—of the air-fuel ratio controller is operated by the output pressure from the averaging totalizing relay, R-3. The pneumatic signals from the fuel-gas and fuel-oil flow transmitters are combined in R-3 to produce an output pneumatic signal which is related to the rate of air flow —secondary flow measurement — required for efficient combustion of the fuels.

Variations in the fuel oil-fuel gas flow ratio will not affect the settings on R-3 because they are determined by only the air required per unit of each fuel.

A ratio relay, R-4, trims the ratio between combustion air and totalized fuel. During operation, manual adjustments of air-fuel ratio may be made, from the record of flue-gas analysis of the oxygen recorder, O_2R.

Air flow . . . The flow of combustion air is determined by measuring the differential pressure across an orifice or venturi section in the forced-draft duct. Theoretically this provides the best measurement. However, in many cases the shape of the air duct makes it impractical to install an orifice or venturi section.

Then, too, a small part of the static pressure output of the fan is absorbed in creating the differential pressure across the orifice or Venturi and this slightly increases the power consumed by the fan.

An alternate method consists of measuring the differential pressure across the air side of the air preheater. Using the differential pressure across the gas side of the air preheater is not recommended because the gas carries dirt which will lodge in the tubes and change the area of the opening.

Another common method is to measure the draft loss across boiler passes. This measurement takes into account the total volume of combustion gases, including air, that has leaked into the furnace.

The output air pressure from the air-fuel ratio controller operates the forced-draft outlet damper.

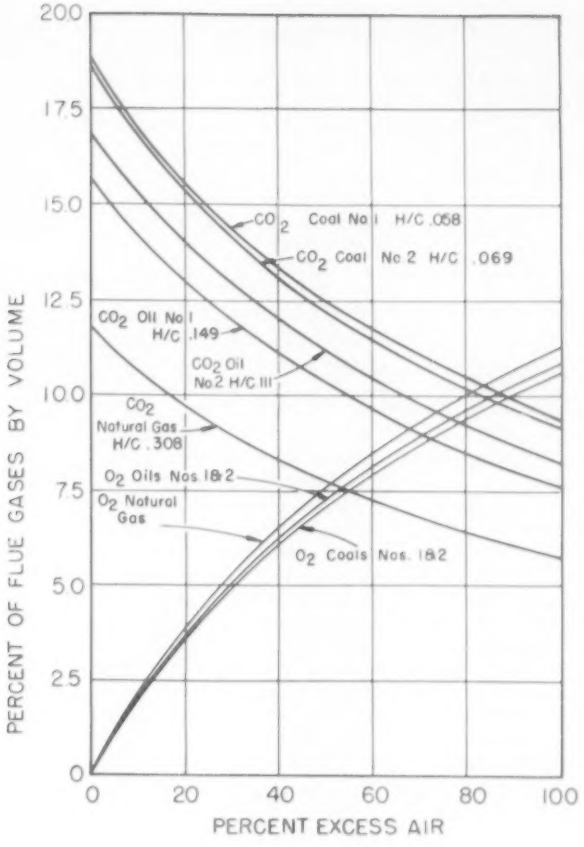
Atomizing steam control . . . A self-actuated controller, DPC-1, measures and controls a differential pressure between atomizing steam and fuel oil. In some cases it may be desirable to use a panel-mounted control station from which the operator can readily change the differential pressure setting for efficient atomization.

Furnace pressure is measured at DG-1 and transmitted, PT, to an indicating furnace pressure controller, which operates the damper in the induced-draft inlet duct. The control point is manually set at the control station for optimum firebox conditions.

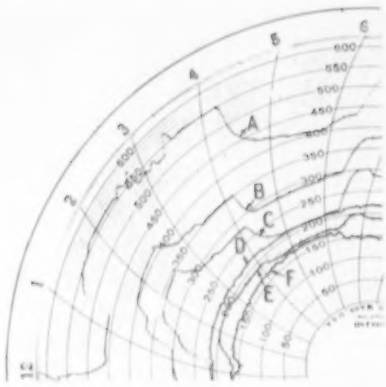
Flue-Gas Analysis

Any fuel of a fixed hydrogen-carbon ratio has a theoretical air requirement for complete combustion. The actual amount of air supplied is always slightly in excess of the theoretical requirements to assure complete combustion by intimate mixing of fuel and air. Once the optimum value of air flow has been determined, it should be maintained accurately, because any deviation from the correct amount will affect operations seriously.

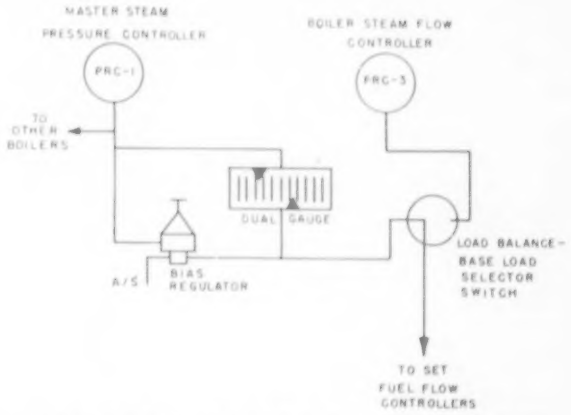
Deficiency of air will result in loss of unburned fuel and may create excessive furnace temperatures, which will increase furnace-maintenance costs. Air greatly in excess of the optimum requirements must be heated to the temperature of the other gases in the furnace. The total volume of furnace



FUEL-FLUE GAS relationships for boiler operation using several different fuels. Fig. 4.



TEMPERATURE CHART shows records of six critical temperatures in the system. Fig. 5.



SEVERAL BOILERS can be tied in to the same system by use of this load balancing-base loading arrangement. Fig. 6.

gases and the gas velocity through the system increases and, with constant fuel input, there is less heat transfer to the water tubes because gas temperatures are lower and retention time shorter.

If the correct fuel-air ratio is to be maintained at all times, a suitable combustion guide is essential. A direct measurement of the oxygen content of the flue gases provides the most satisfactory analysis, especially when the hydrogen-carbon ratio of the fuel may be varying.

Air-CO_2 relationship . . . Fig. 4 shows the relationship between excess air and oxygen or carbon dioxide in flue gas for several different fuels. The relationship between oxygen percentage and excess air varies by only a small amount for all fuels, while the carbon dioxide percentage varies widely with variations in the hydrogen-carbon ratio.

A shift from firing 100 per cent gas to firing 100 per cent No. 2 oil with 20 per cent excess air will change the carbon dioxide content from approximately 9.8 per cent to 13.6 per cent. Yet, the oxygen content varies only about 0.2 per cent for this same change. Once the required amount of excess air is known for the correct combustion of any fuel or mixture of fuels, the correct fuel-air ratio can be readily maintained, using the percentage of oxygen in the flue gases as a guide.

Analysis of flue gas for carbon dioxide content is usually limited to those applications where a single fuel is burned. In Fig. 4, a straightforward correlation exists between excess air and carbon dioxide percentage in flue gas for any single fuel of known composition.

Steam-drum and feed-water pressures are measured and indicated by individual direct-connected gages, PI-1 and PI-2.

A vertical-scale draft gage with five pointers, DG, is used to indicate forced-draft fan outlet DG-4, flue-gas outlet from air heater, DG-3, windbox DG-5, furnace DG-1, and boiler outlet pressures DG-2.

Steam generator . . . An electronic recorder measures six critical temperatures and continuously records them on a large, easy-to-read 24-hour chart. The points of temperature measurement are: process steam TR-1, feed water entering the boiler TR-2, flue gas entering the air preheater TR-3, flue gas leaving the air preheater TR-4, combustion air entering the preheater TR-5, and combustion air leaving the preheater TR-6.

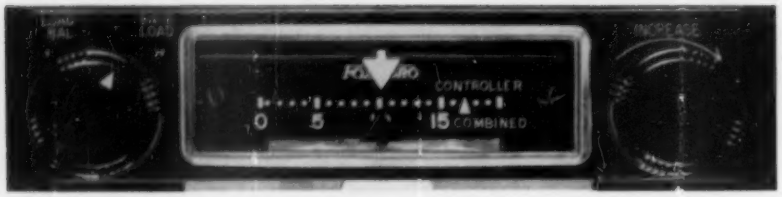
A full-size section of a chart with these temperatures recorded is shown in Fig. 5. Temperature deviations or combinations of deviations will be significant to the plant supervisor. By using the chart as an operational guide, steam-boiler performance can be checked at all times and maximum efficiency maintained.

Load Balancing

This control system is applicable to a single boiler installation; however, it can be easily modified to accommodate a multiple boiler installation.

Fig. 6 shows schematically an arrangement for multiple operation.

A bias regulator for load balancing is in the output air line from the master steam pressure controller, to each boiler. With this regulator, the operator modifies the master controller out-



SUBPANEL for load balance-base loading system. Fig. 7.

put to adjust the relative loading of the individual boilers. Fig. 7 shows the subpanel with load balance-base load selector switch and a dual pressure gage which shows the amount of bias.

The master steam-pressure controller may be isolated from the boiler-control system for base loading by turning the selector switch to the base load position. While on base load, the boiler can be operated at any rating by setting the index of the boiler steam-flow controller, FRC-3, Fig. 6.

Drum-level control . . . Accurate and dependable boiler feed-water control is necessary for safe operation of modern steam generators, which usually combine high steaming rate with small drum capacity. The total volume of water in the boiler is small compared with the throughput, and there is insufficient capacity to protect the boiler during rapid changes in the steaming rates.

With such boilers, feed-water control cannot be based on level measurement alone because of boiler "swell" which occurs when the steaming rate of the boiler is suddenly increased. Such increase produces a greater volume of steam in the tubes and the water is displaced into the drum. Level control alone would shut down on the water feed rate so quickly that a violent cycle would be started as shown in Fig. 8.

It is desirable that the increase of water in the drum be used up without reducing the rate of feed-water flow too quickly.

Three-Element Control

The three-element system of steam flow, feed-water flow, and drum-level measurement shown in Fig. 9 maintains drum level within safe limits, even during rapid swings in boiler load—by holding a definite steam-output feed-water ratio. For each pound of steam used, a pound of feed water is immediately added. If, for any reason, the correct drum level is not maintained, the ratio setting is automatically changed.

In this system, a flow ratio controller, FRRC-2, records the rate of steam flow output — primary measurement, and rate of flow of boiler feed water—secondary measurement—on a single chart and controls automatically the feed-water rate to maintain a precise relationship between water input and steam output.

Recording level controller, LRC-1, automatically adjusts the ratio setting of FRRC-2 through the ratio relay R-5 to assure the correct drum level. An adjustable restrictor unit, D-1, in the output pressure line from the liquid-level controller adjusts the response to level changes to match the time constant of the boiler.

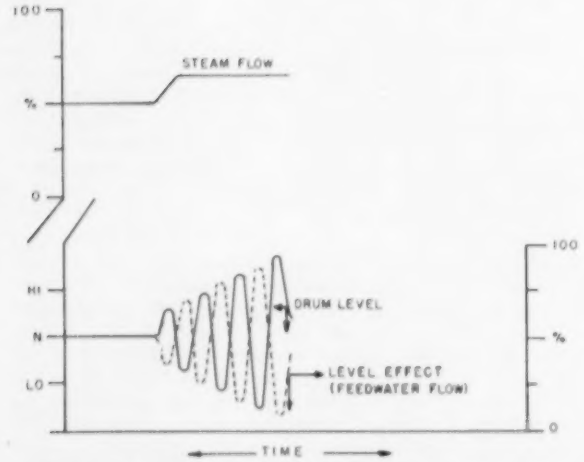
Two-Element Control

In smaller-sized boilers where the load changes are less severe or the drum capacity is larger, the simpler two-element control system has been used with good results.

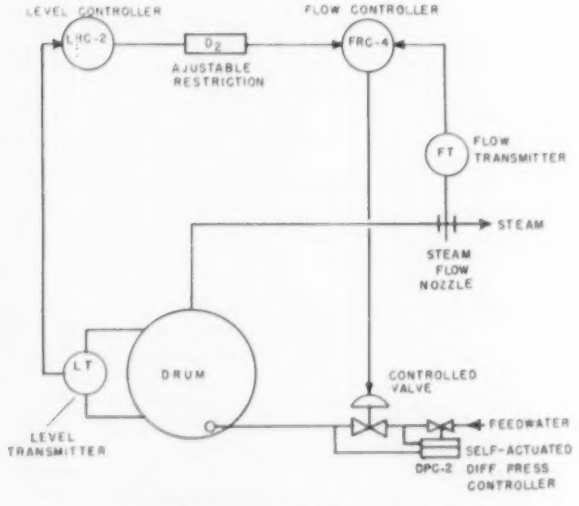
Fig. 9 shows schematically a two-element system in which a flow recorder controller, FRC-4, controls the rate of flow of boiler feed water from a measurement of the rate of flow of output steam; and a level recorder controller, LRC-2, resets the control point of FRC-4 from a boiler level measurement change. The adjustable restricter, D-2, in the output pressure line from LRC-2 prevents the surging conditions of boiler swell from upsetting the proportional response.

A self-actuated differential pressure controller, DPC-2, controls a constant pressure drop across the feed-water control valve to compensate for the change in pressure drop caused by load changes.

"The three-element system of steam flow, feed-water flow, and drum-level measurement maintains drum level within safe limits even during rapid swings in boiler load by holding a definite steam output feed-water ratio."



RESPONSE OF SINGLE-ELEMENT level control applied to a high steaming rate-low drum capacity boiler. Fig. 8.



TWO-ELEMENT drum level control. Fig. 9.

How T.G.T. Cuts Operating Costs . . .

. . . through better pipeline compressor techniques

● Increasing engine horsepower by supercharging, scavenger-air cooling, higher compression ratios; decreasing wasted horsepower by careful studies of station piping, better selection of compressor cylinders as to clearance volumes—these are the ways T.G.T. has cut operating costs while adding to its system capacity. This article gives results of the techniques used.

by O. H. Moore

THE volume of gas transported daily by Tennesseee Gas Transmission Co. is so large that a slight improvement in efficiency of compressor equipment often returns the cost of obtaining that improved efficiency many times. Specific fields of improvement have been in more efficient compressor cylinders, better fuel economy, and higher compression and turbocharged engines.

The present-day installation costs of new compressors makes the modification of old equipment an attractive project at almost any conversion cost. This is especially true in compressor buildings that have already reached their ultimate design in the number of installed units. Increasing the horsepower on the individual units does not call for an increase in the number of employes and, in almost every case, improves fuel economy of engine.

Author is director of operating research, Tennessee Gas Transmission Co., Houston. Paper was presented at the Texas Petroleum Research Committee meeting, Texas A. & M. College, College Staton, Tex., April 10, 1956.

Method of Increasing Horsepower

Compression pressure . . . Raising the compression pressure is a definite possibility for most of T.G.T.'s engines. Where this is done, we get a flat 10 per cent increase in horsepower, with a resulting improvement in fuel economy. This conversion to higher compression is done by changing power-cylinder heads.

Tailored scavenger air . . . Experimental work on two-cycle engines indicates that an additional 5 to 7 per cent increase in horsepower is available through cooling of the intake air to the engines. Heat exchangers were placed between the scavenger air cylinders and power cylinders to remove the heat of compression from the intake air. This cool intake air also resulted in an improvement in fuel economy. (See Fig. 1).

Turbocharged engines . . . Sufficient operating experience is now behind the first installation of turbocharged equipment on two-cycle engines to prove that this type unit can be operated in this manner. There are two types of installation: the pulse type calling for individual exhaust lines from the cylinders to the exhaust turbine, and the constant-pressure type where a common header to all cylinders carry the exhaust gases to the turbine.

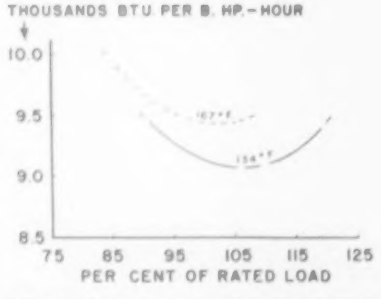
Starting of engines with either type installation is not too difficult, and there does not seem to be any end to the extent of load they will carry so long as there is sufficent scavenger air. The fuel curve takes an entirely different shape from that of one from the conventional-type two-cycle engine.

T.G.T. is now installing exhaust turbine-supercharge equipment on a 1,600-hp. twin-tandem, double-acting horizontal, four-cycle gas engine. We expect to take as much as 25 per cent more horsepower out of this unit. A similar installation has been in service on another pipeline for some time, and we have reports of very promising results.

Fig. 2 shows the type of fuel curve obtained from a turbocharged two-cycle engine.

Station Piping

The volume of gas moving through T.G.T.'s network of piping requires a careful study on the part of the designing engineer. Excessive pressure drop through a station yard or inadequate design of the piping to even an



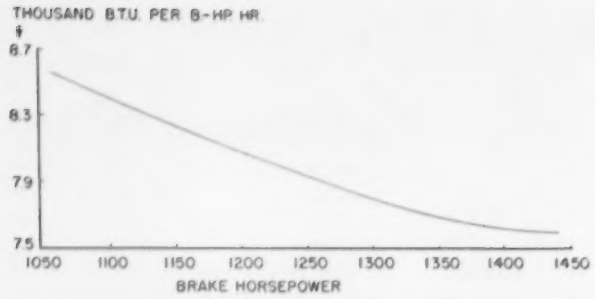
ENGINE fuel-consumption characteristics with cooled vs. noncooled scavenger air. Fig. 1.

PIPELINING

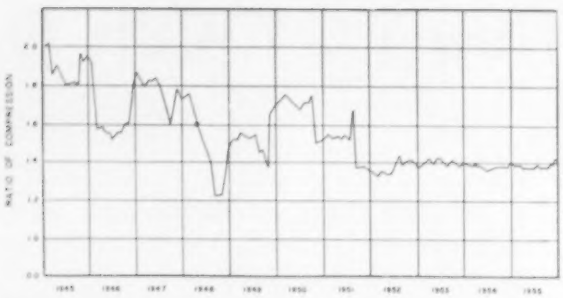
Tennessee System One of Nation's Largest

Tennessee Gas Transmission Co.'s high-pressure, multiple-pipeline, gas-transmission system extends from the Mexican border to the New England seaboard. Wide variations in operating problems are encountered throughout the line. This calls for constant vigilance by T.G.T.'s compressor department to keep pace with the problems encountered in the operation of the compressor equipment required to move upwards of 2 billion cubic feet of gas per day. Even though an extensive long-range study is made in the initial plans as to capacity, pipe size, compressor-station spacing, gas purchase and gas sales points, many complicated problems enter the picture when a company expands almost 10 times its initial size in a span of 12 years.

Tennessee Gas has, at present, 27 main-line compressor stations with a total of 537,720 hp. installed to work on the gas stream. The daily labor cost for 1955 runs to five figures. Fuel consumption of 93 M.M.c.f.d. is about one-half of the initial capacity of the system. The equivalent of a 3,000-gal. transport truck is required to make a daily trip to keep the system supplied with lubricating oil.



FUEL-CONSUMPTION CURVE for GMV-10 Cooper-Bessemer turbocharged two-cycle engine. Fig. 2.



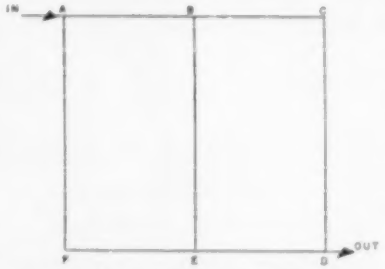
RECORD of monthly average ratio of pressures at one T.G.T. compressor station. Fig. 4.

individual engine can offset the expected increase in station efficiency when making a change in construction to gain more horsepower. To handle 2 billion cubic feet per day a single station horsepower requirement goes up to approximately 40,000 hp. This means a complicated network of yard piping.

Within the multiple-building compressor station, it is possible to attain a wide variation of horsepower requirements, even when throughput, pressures, temperatures, and station header ratios of pressures remain constant. The variation in horsepower requirements is caused by varying the relative proportion of the total flow which each engine room handles.

Pressure drop in gas lines depends approximately upon the square of the flow, and required horsepower depends upon the ratio of pressures which is a function of the pressure loss. Therefore, other conditions remaining constant, it takes more horsepower to compress a cubic foot of gas at high flow than it does at low flow. Hence, operating costs rise as the flow increases.

A study of station-yard piping has necessitated a "lot of doing" and we feel that we have approached the problem in a manner that appears to have



PRESSURE DROP in various sections of pipe configurations are calculated by the Hardy Cross method. Fig. 3.

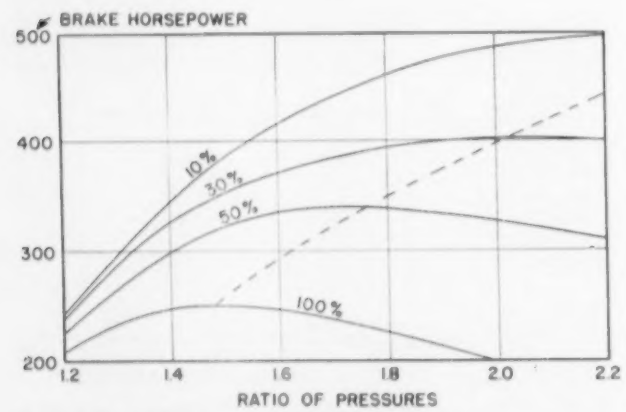
merit in its application. C. H. Klohn, of T.G.T., has adapted the Hardy Cross method of analyzing a flow network to a particular problem of compressible flow. The Hardy Cross system is based on the principle that a fluid will automatically assume the most efficient distribution through the network *(See The Oil and Gas Journal, July 25, 1955, page 178, for a detailed description of this method).*

That is, if in Fig. 3 you put into the system at A and take out at D, the algebraic summation of the pressure drops AB plus BC plus CD must equal the algebraic summation of the pressure drops AF plus FE plus ED.

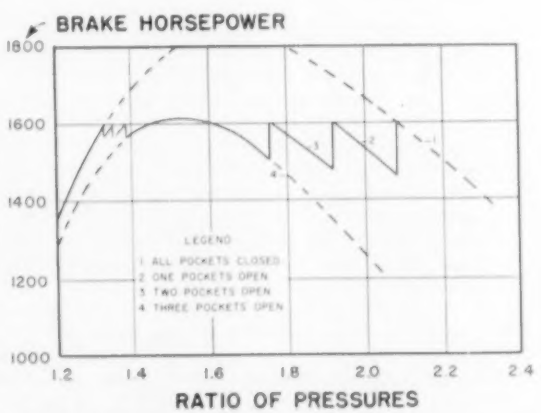
The Hardy Cross system has been simplified to the extent that all you need to know to use the proposed method of calculation is the per cent of flow through each of the different compressor stations. After you have this per cent of flow, you can then calculate the pressure drop for any temperature, and pressure, and any total flow through the station-yard network.

Yard piping has been redesigned at several stations, which has resulted in savings up to 1,200 hp., with a corresponding increase in gas compressed without the addition of extra horsepower.

Compressor cylinders . . . The development of the large clearance cylinder was a necessity in the long-line gas-transmission service. Operating pressures at the compressor stations do not change materially from day to day, but there is a definite change from year to year in an expanding company. The extent of change will vary with the type of expansion program. The effect of this program is best shown by a plot of the ratio of pressures for 10 years of operation for T.G.T. shown in Fig. 4. The ratio of pressures appears to be levelling out at about 1.4, having dropped from 2.0 ratio for the initial design.



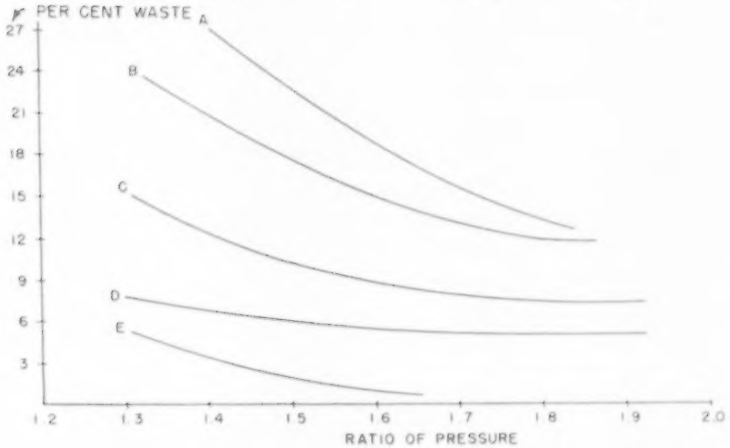
EFFECT OF CLEARANCE on loading characteristics of compressor cylinders. Fig. 5.



TYPICAL LOAD CURVE of compressor cylinder with variable clearance pockets. Fig. 6.

COMPOSITE WASTE CURVES FOR FIVE COMPRESSOR CYLINDERS

CURVE END	BORE SIZE	NO. VALVES PER END	PER CENT CLEARANCE	VALVE LIFT AREA IN SQ. IN.
A	7 1/2"	2	9.5	5.51
B	7 1/2"	2	11.3	5.893
C	10	4	14.2	9.32
D	8 3/4	4	20.2	9.32
E	13 1/4	4	59.4	26.11



PER CENT WASTE in compressor cylinders versus ratio of operating pressures. Fig. 7.

The peaks and valleys in the graph are the results of construction programs either at this compressor station or on the main line, such as addition of compressor equipment or main-line looping. This construction does not necessarily have to be at a given station or on the main line adjacent to a station. Addition of compressor equipment or looping of the main line at other stations will change operating pressures at several stations. The greatest effect is, of course, felt at the station nearest the construction. The tie-in of a new sales point or a tiein of a new gas purchase point will have its effect on the operating pressures.

Generally speaking the peaks in a ratio of pressure curve are the results of the installation of additional horsepower, and the valleys are the results of main-line looping. This is especially true in the early years of operation of a pipeline system. These changes in the ratio of pressures are going to be rather stable on T.G.T.'s system from now on because of the size of the network. Most stations on the line have become so large that installing additional compressors will have a minor effect on the operating pressures as compared to what an equivalent installation would have had in the early years of operation. This same thing is true for construction of additional pipeline facilities.

Compressor Cylinder Loading

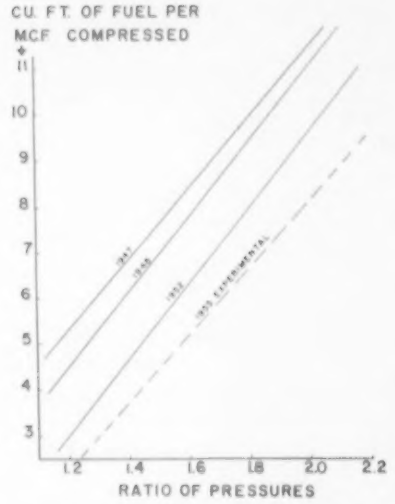
These changes in ratio of operating pressure affect the loading characteristics of a compressor cylinder in direct relation to its per cent clearance.

Fig. 5 depicts the effect of clearance of the loading characteristics of a compressor cylinder operating under different ratios of pressures.

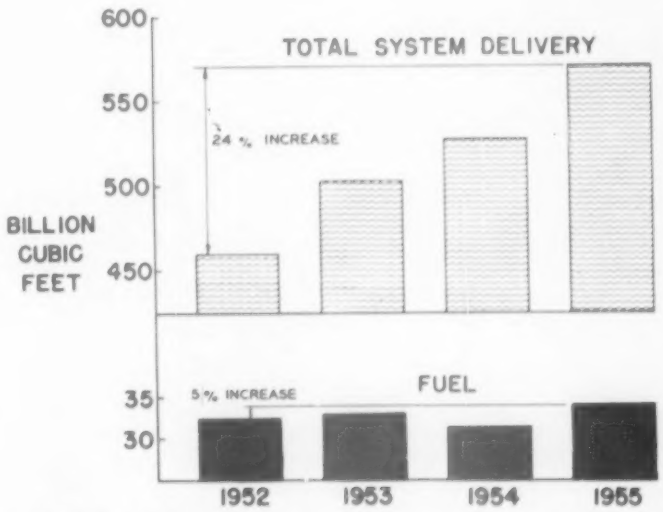
Most of the compressor cylinders purchased on our initial engines had fixed clearances in the range of the 10 per cent curve with one clearance pocket in the head end of the cylinder. As the operating ratios of pressure dropped through the years, these cylinders were changed out in favor of cylinders with larger clearances. Cylinders with clearances in the 10 per cent range are best suited for ratio of pressures above 2.0. This is best shown from Fig. 5, where a change from 2.0 to 1.4 ratio means a reduction of approximately 28.5 per cent in the load factor, whereas a cylinder with 50 per cent clearance would have a load-factor change of only 0.8 per cent.

An increase in per cent clearance means a reduction in the horsepower of the cylinder. Therefore, to maintain the horsepower, cylinder diameter must increase. This means bigger cylinder bodies which, in turn, permits larger gas passages or the installation of more compressor valves in each end of the cylinder or, if preferred, larger valves. This improved design lowers the pressure drop within cylinder proper, releasing more horsepower to pump gas.

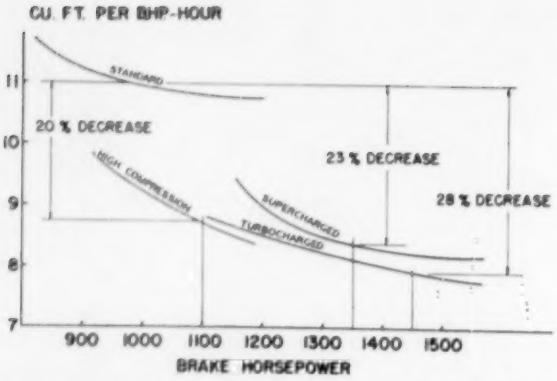
Fig. 6 is a typical load curve on



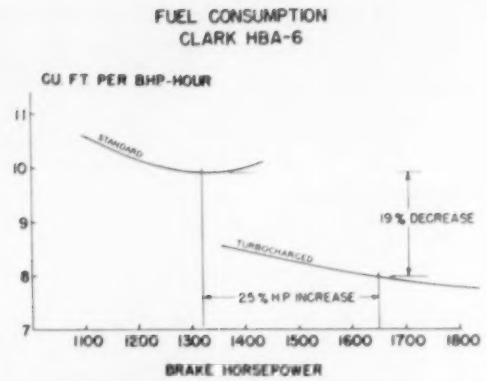
SYSTEM AVERAGE figures for cubic feet of fuel consumed per thousand cubic feet of gas compressed. Fig. 8.



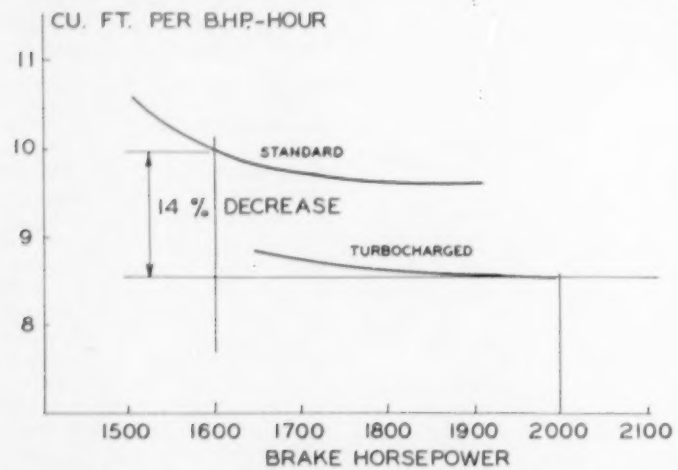
FOUR-YEAR COMPARISON of total gas compressed versus total fuel used. Fig. 9.



COMPARATIVE FUEL-CONSUMPTION curves for Cooper-Bessemer GMV-10 engines. Fig. 10.



COMPARATIVE FUEL-CONSUMPTION curves on Clark Brothers HBA-6 engines. Fig. 11.



COMPARATIVE FUEL-CONSUMPTION curves on Worthington UTC-168 engines. Fig. 12.

new compressor cylinders purchased under the present policy in the selection of cylinders. The cylinder size and total per cent clearance is selected so as to give full load with maximum clearance at the expected ratio of operating pressures. This clearance is then divided between fixed clearance and clearance pocket in order to spread the load range through as wide a range as desired. At low ratios of pressures, all pockets are operated closed; then as the ratios go up, clearance pockets are opened to prevent the cylinder from overloading. This change in clearance progresses in steps until maximum clearance is reached.

Should the ratio of pressures continue to rise, the horsepower would begin to drop off due to the effect of excess clearance on the loading characteristic of the cylinder. Clearance pockets are then closed in steps, each in turn decreasing the per cent clearance, bringing the cylinder back up to rated load. Cylinders of this type permit peak operating efficiency through a wide range of ratio of pressures.

Fig. 7 shows improvements accomplished in operating efficiency of compressor cylinders through a better selection of said cylinders.

Fuel Consumption

Fuel consumption on a long-line transmission system is of major importance. Gas is compressed again and again as it moves up the line and, at each compression, gas is used out of the line to furnish the horsepower necessary to raise the gas from the suction pressure on the inlet side of the station to discharge pressure on the outlet side. The value of this fuel gas theoretically becomes that of the sales price of the gas once it reaches the point on the system where there is no more gas put into the system from the sources of supply.

Any savings, therefore, in fuel consumption affects the economy of the system. The best data showing the improved fuel consumption experienced on the T.G.T. system is that showing the comparison by years of cubic feet consumed versus cubic feet of gas compressed.

Fig. 8 represents the comparison of cubic feet of fuel consumed per thousand cubic feet of gas compressed by years, plotted against ratios of pressures.

Fig. 9 is another comparison of fuel used versus gas compressed. This 5 per cent increase in total fuel consumed from 1952 to 1955 compared to the 24 per cent increase in gas compressed represents a change from 7.06 to 5.96 per cent of total fuel consumed, versus total system delivery. This improvement in fuel consumption shown in Fig. 8 is the result of more efficient compressor cylinders, improvement in fuel-consumption characteristics of individual engines, and improvements in the over-all design of the station-yard piping and the mainline network.

The improvements realized in the fuel consumption of the individual compressor equipment are best shown in Figs. 10 through 16. These improvements are the results of the combined effort on the part of the engine manufacturers and T.G.T.'s compressor-department personnel working together for the common cause—higher efficiency means more dollars in the till.

BOOK

1955 BOOK OF A.S.T.M. STANDARDS—Part 5: Fuels, Petroleum, Aromatic Hydrocarbons, Engine Antifreezes. Published by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3. 1460 pp.

The Book of A.S.T.M. Standards, of which this is part 5 of the 1955 edition, is a triennial publication with supplements issued in the intervening years. It contains the formally adopted A.S.T.M. standards and the A.S.T.M. tentative specifications, methods of tests, and definitions.

The subjects covered include (1) petroleum products and lubricants; (2) A.S.T.M. engine-test methods for rating fuels; (3) methods of measuring and sampling petroleum and petroleum products, coal and coke, gaseous fuels, industrial aromatic hydrocarbons, engine antifreezes, and thermometers, and (4) general testing methods.

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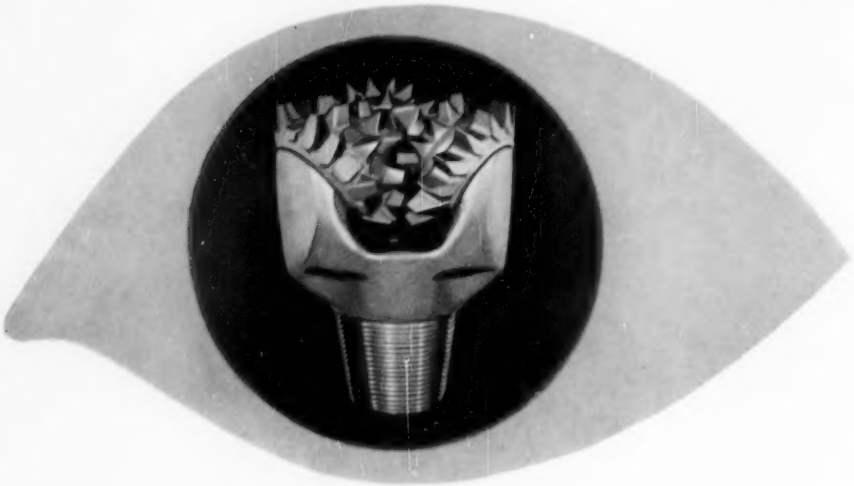
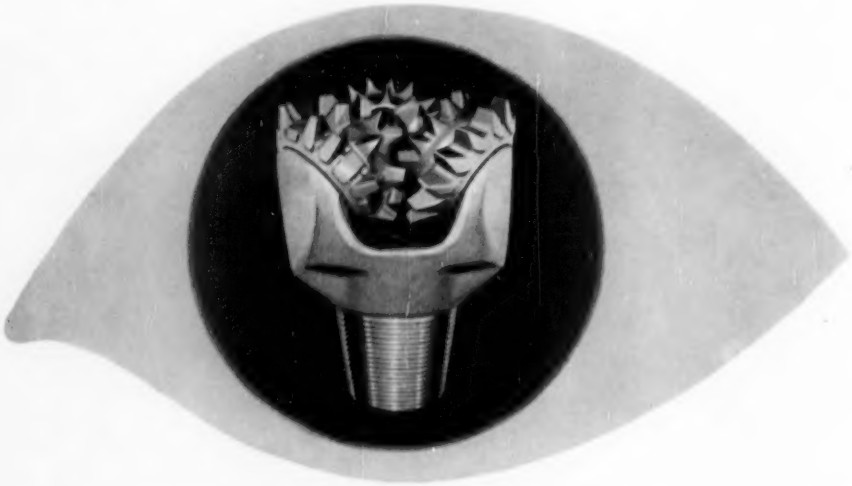
Fording Peace River . . . painted from actual photograph



THEY LOOK ALIKE ... but



there's a difference in their performance

Looks can be deceiving. Because bits look alike is no assurance they will perform alike.

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Amerada and Pacific Northwest in lead as

Williston Basin Dominates Rockies Drilling

by John C. McCaslin

This summary of Rocky Mountain operations covers activity in a seven-state area for a period of one month. Data for the summary were compiled by the Journal's exploration department using a new and experimental punch-card system.

THE Journal's survey of drilling operations in the Rocky Mountains in January reveals that Amerada Petroleum Corp. led the major operators in the number of successful oil-well completions; Pacific Northwest Pipeline Co. was first in gas-well completions.

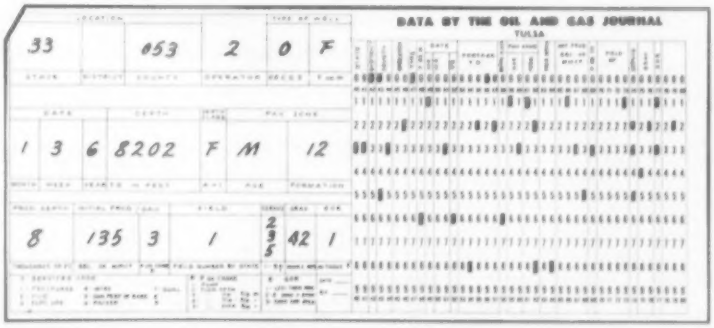
Initial production of Amerada's oil-well completions was 2,704 bbl. Most of these wells were completed in the Williston basin. Continental Oil Co. was second with 988 bbl. initial production in the Rockies. Amerada also drilled the most footage of all the 10 leading operators in the region . . . 138,604 ft. (successful wells only).

Total completions . . . Total well completions in the Rocky Mountain states in January reached 383. Of these, 95

THE BIG TEN IN ROCKIES COMPLETIONS

	Oil wells	Gas wells	Dry holes	Footage drilled	Initial production of oil (bbl.)
1. Amerada	16	0	2	138,604	2,704
2. Pacific Northwest	0	18	0	105,452	
3. El Paso	0	12	4	67,868	
4. Stanolind	4	5	7	67,043	688
5. Shell	7	0	4	68,416	987
6. British-American	4	0	6	54,614	546
7. Continental	4	1	5	50,094	988
8. Sohio	2	1	5	39,687	190
9. Ohio	3	1	3	32,388	571
10. Phillips	4	1	1	24,226	602

How these data were analyzed . . .

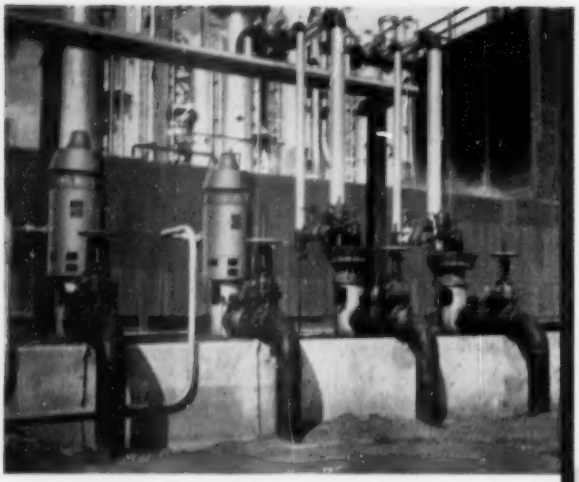


The sample data card is a North Dakota oil-well completion history. Decoded it reads: North Dakota (33), Williams County (053). Amerada (2), field oil well. Completed January (third week) 1956; TD 8,202 ft. Depth class is 7,500-10,000 ft. Mississippian (M) Madison (12). Produces in the 8,000-ft. zone, 135 bbl. of oil per day, 16/64-in. choke. Beaver Lodge field (1). The well was acidized (2), logged (3), and perforated (5). Gravity is 42°. Gas-oil ratio was less than 1,000.

WELL COMPLETIONS IN IMPORTANT FIELDS

	Init. prod.	Oil	Gas	Dry
Colorado				
Jackpot	1,313	3	0	0
Bondad	25	1	4	1
Thornburg	0	0	1	0
Plum Bush Creek	0	0	0	3
Powder Wash	0	0	1	0
Beacon	130	1	0	0
Kejr	150	1	0	0
Others	553	7	3	25
Total	2,171	13	9	29
Montana				
Cut Bank	281	5	0	2
Pine	570	3	0	0
Others	816	6	1	5
Total	1,667	14	1	7
West Nebraska				
Kimball	252	2	0	1
Long	80	2	0	1
Sloss-State	504	2	0	0
Cizek	395	2	0	2
Olsen	337	2	0	0
Spearow	493	2	0	0
Rudolph	377	2	0	0
Others	1,254	7	0	13
Total	3,692	21	0	17
Northwest New Mexico				
Aztec			4	2
Blanco			22	0
Fulcher-Kutz			7	0
Others	51		18	4
Total	51	1	51	6
North Dakota				
Beaver Lodge	198	1	0	0
Hofflund	423	2	0	0
Tioga	411	3	0	0
Others	1,012	6	0	2
Total	2,044	12	0	2
Utah				
Bar-X			1	0
Coalbed Canyon				1
Total	0	0	1	1
Wyoming				
Garland	88	2	0	0
Manderson	106	2	0	0
Others	3,593	25	3	4
Total	3,787	29	3	14
Total Rockies	13,412	90	65	75

How we work steel to make steel work for you



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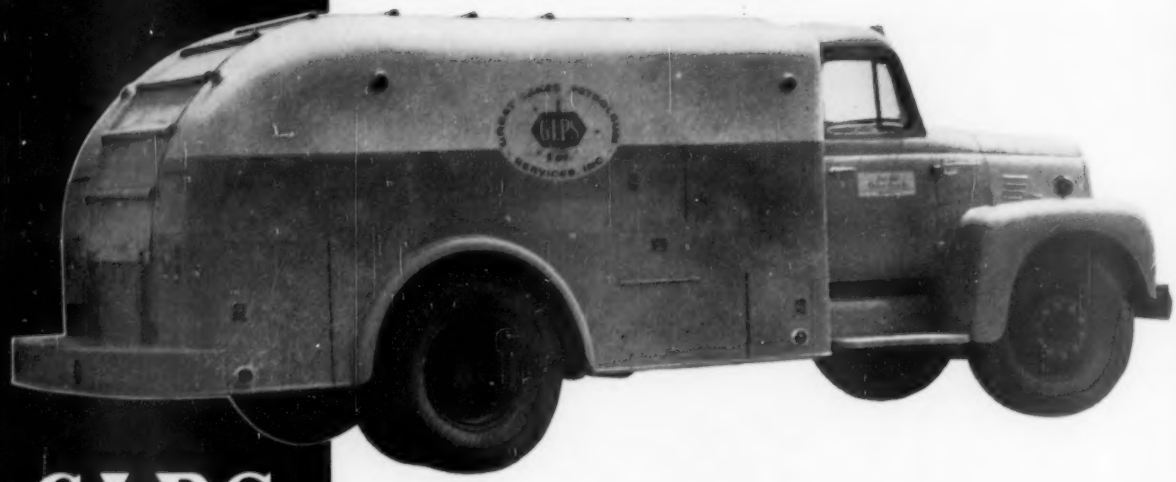

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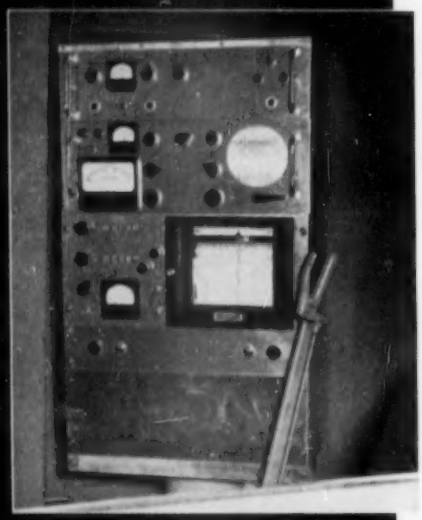

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PUMPING AND FLOWING WELLS, AND DEPTHS

Pumping		Flowing		Avg. prod. depth (ft.)	
Colorado	5	Colorado	8	Colorado	4,800
Montana	12	Montana	4	Montana	3,882
Nebraska	21	Nebraska	1	Nebraska	5,045
New Mexico	1	North Dakota	11	N.W. New Mexico	3,185
North Dakota	1	Wyoming	9	North Dakota	7,667
				Utah	3,000
Total	40	Total	33	Wyoming	4,257
				Rockies	4,295

WELL-COMPLETION SERVICES, BY STATES

	Fractured	Acidized	Logged	Perforated	Total producers	Total wells
Colorado	10	1	53	23	25	106
West Nebraska	6	0	37	21	22	77
Northwest New Mexico	47	0	48	15	54	62
Utah	1	1	1	1	1	3
Wyoming	11	6	43	33	35	77
Montana	0	5	16	7	17	33
North Dakota	0	12	11	13	12	18
Total Rockies	75	25	209	113	166	376

were oil wells, 76 gas, and 212 were dry holes. Total footage drilled in the province was 1,978,155 ft.

Total wildcat completions in the seven-state region hit 147 (3 oil, 9 gas, and 135 dry). Total exploratory footage put down was 771,684 ft.

Colorado led the region in the number of wells drilled with 104. Wyoming led the province in the number of successful wells with 33. Nebraska was second with 22 oil wells. Initial daily production for all successful well completions in the Rockies was 13,707 bbl. of oil. Average depth of all wells completed was 5,100 ft.; average producing depth was 4,290 ft.

Depth classifications . . . The leading depth class in the Rockies is the 5,000-7,500-ft. category with 159 completions. There were 71 wells completed in the 3,750-5,000-ft. class; 50 in the 2,500-3,750-ft. class; 42 each in the 1,250-2,500-ft. and 7,500-10,000-ft. class; 10 in the below 1,250-ft. class, and 9 in the 10,000-12,500-ft. class.

Leading pay zones . . . The Madison-Mississippian lime of Montana and North Dakota led the list of producing sands in the Williston area. In Montana there were 9 oil wells completed in the Madison; in North Dakota 12.

Colorado's "J" sand produced in 6 oil wells, 3 gas wells, while in Nebraska the "J" sand accounted for 20 oil wells. The leading pay sand in the San Juan basin is the Pictured Cliffs sand with 28 gas wells. In Wyoming the Tensleep produced oil in six wells.

Services by states . . . Of the total wells completed in the Rocky Mountains 75 were fractured, 25 acidized, 209 logged, and 113 perforated.

Fracturing was used in 47 wells in Northwest New Mexico. In North Dakota acid was used on 12 wells, 6 in Wyoming, and 5 in Montana.

Important field-well statistics . . . Jackpot field in the Denver-Julesburg basin of Colorado led the entire region in initial production with 1,313 bbl. Wyoming led all states with 3,787 bbl. initial production. Total initial production in the province amounted to 3,787 bbl. from field-well completions, 295 from wildcat discoveries.

In Montana the Pine Unit was the best oil field with 570 bbl. initial production from three wells. Sloss-State field in Nebraska led that state with 504 bbl., initial production for two wells. Hofflund field in North Dakota had initial production of 423 bbl., two wells. The two oil wells completed in Manderson field had initial production of 106 bbl. to take the lead in Wyoming.

The average initial production per well for Colorado was 167 bbl.; 116 in Montana; 261 in Nebraska; 51 in Northwest New Mexico; 171 in North Dakota, and 132 in Wyoming.

There were 40 wells put on pump in the seven-state area.

Wyoming led the entire region in the number of wells completed on choke for flowing potentials with nine. The total number of wells completed flowing in the region was 33.

Producing depths . . . The deepest production in the Rockies (average) is in North Dakota with 7,667 ft. Western Nebraska is second with 5,045 ft. Utah's average producing depth is the shallowest . . . 3,000 ft. The average producing depth of the whole region is 4,290 ft.

"The Madison-Mississippian lime of Montana and North Dakota led the list of producing sands in the Williston area. In Montana there were 9 oil wells completed in the Madison; in North Dakota 12."

ANALYSIS OF PAY SANDS, ROCKY MOUNTAINS

	Oil wells	Gas wells	Initial prod.
Colorado			
"D" sand	1	0	60
Dakota sand	4	0	289
Frontier sand	1	1	60
"J" sand	6	3	1,759
Mesaverde	1	1	3
Lansing	0	1	....
Weber	0	1	
Others	0	4	
Total	13	11	2,171 (167 av.)
Montana			
Amsden-Pa.	2	0	310
Madison-Miss.	9	0	619
Red River-Ord.	2	0	316
Other Ord.	1	0	233
Miscellaneous	1	1	564
Total	15	1	1,732 (116 av.)
Nebraska			
"D" sand	1	0	125
Dakota	1	0	61
"J" sand	20	0	3,567
Total	22	0	3,753 (261 av.)
Northwest New Mexico			
Dakota	1	0	51
Upper Cretaceous	0	12	
Pictured Cliffs	0	28	
Point Lookout	0	13	
Total	1	53	51 (51 av.)
North Dakota			
Madison	12	0	2,044
Total	12	0	2,044 (171 av.)
Utah			
Green River	0	1	
Wyoming			
Big Horn-Ord.	1	0	152
Dakota	1	1	179
Frontier-U.K.	1	0	40
Embar-Permian	3	0	592
Lakota	1	0	126
Madison	4	2	498
Muddy	4	1	226
Newcastle	1	0	125
Tensleep	6	0	1,496
Others	8	0	522
Total	30	4	3,956 (132 av.)

Indexing Sub

OBJECTIVES of the A.P.I. Southwestern District Study Committee on Jet-Bit Drilling have been to recommend proper use of hydraulic horsepower and to determine the limits for jet-bit drilling. Conclusions obtained from the committee's work in hard-rock drilling are:

1. Bit horsepower is of little consequence at drilling rates below 14 ft. per hour as long as adequate cleaning is provided.

2. Drilling rates are not materially increased with 110 or less bit horsepower unless drilling rate with conventional bit is at least 26 ft. per hour. Some adjustment in this value is possible because of scatter of data.

3. At low drilling rates, 25 ft. per hour or less, use of power to increase rotary speed a few revolutions per minute is more vital to penetration than to increase bit horsepower.

4. Parasite loads in the circulation system can be reduced and the same penetration rate maintained if the fluid volume and nozzle size are reduced and the bit horsepower held constant. Adequate cleaning must still be maintained.

The work presented in this paper is a general guide and fits only 8¾-in. hole with 60,000 to 70,000 lb. weight and 50 to 80 r.p.m. More work needs to be done to better establish the effective upper ranges of horsepower.

Use of indexing sub . . . Defining the practical limits for use of jet bits in hard-rock drilling has proved to be more than difficult. Analysis of drilling reports and bit records did not give the desired results. Basic differences in drilling techniques as well as unreliable data confused the picture.

During the period of introduction and acceptance of jet bits in the area covered by the present Southwestern District, several bits were run using a sub which could alternately change the flow of drilling fluid from jet to conventional water courses. Results obtained in these tests showed a substantial increase in penetration rate by the switch to the jet water courses.

The amount of gain produced with the jet sub could not be shown in the over-all drilling rate for wells drilled with jet bits as compared to those drilled with conventional bits. Differences in bit horsepower, drilling practices, and other variables made it desirable to be able to vary the nozzle area while drilling. The fluid volume on some tests needed to be changed to obtain the desired bit horsepower or nozzle velocity.

Changes were made in the indexing sub which permitted changing nozzle area while drilling.

With the indexing sub equipped to vary bit horsepower while drilling, it was assumed that the objectives of the study committee would be reached in a short time. After 1 year of using the sub, many questions remain unanswered. However, enough data have been obtained to aid users of jet bits and to more clearly define the range of further investigation.

Running the tests . . . An effort was made to run the indexing sub in uniform sections. Drilling rates and geolograph charts on previously drilled wells were checked carefully to select these uniform sections. Figs. 2 and 3 illustrate how variable a formation can be when each foot is checked with a stop watch. The geolograph gives some indication of drilling-rate variation, but the chart in Fig. 3 shows that the drilling rate for 5-ft. intervals actually varied from 19.5 to 42 ft. per hour.

For this reason the individual foot was timed with a stop watch and, where necessary, erratic sections were omitted in the averages. For example: If the drilling rate was approximately 1.25 minutes per foot and then 2 ft. took 2.2 and 2.5 minutes per foot, respectively, they would be eliminated from the averages.

Until only uniform sections were selected and obvious formation hard or soft spots rejected, it was impossible to establish a trend from the data.

After a zone had been selected in which to run the test, it was necessary to select nozzle size and bit type. It was not uncommon to have the sub prepared with bit and nozzles then have the formation change. This then delayed the use of the sub.

If the delay were long enough, it would cause abandoning a run for the

How indexing sub works . . .

The selected 8¾-in. bit must be bucked into the sub in proper alignment so as to permit welding of the three jet tubes (I). The other end of each jet tube is placed in its respective port in the side of the sub and sealed with O-rings.

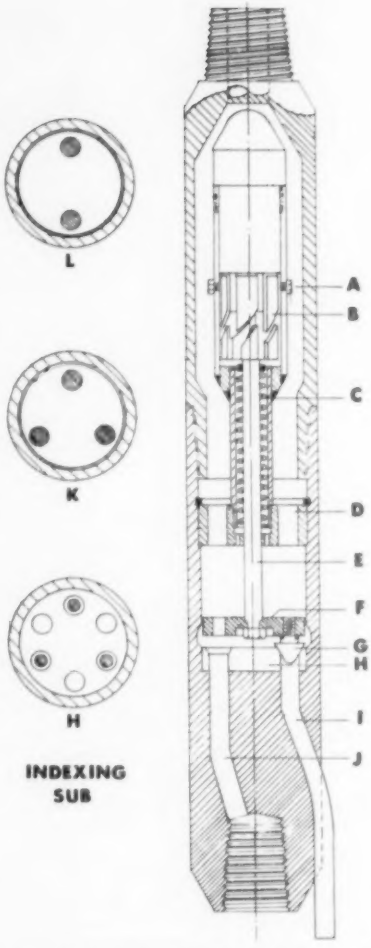
Inside of the sub, located immediately above the jet tube entrance ports, is a stationary valve seat plate (H) containing six water-course ports. Three of these ports are directed to the jet tubes and three lead to the conventional water courses (J) through the bit.

The switch mechanism is lowered into the sub, valves (G) first. A section of key stock, inset on the expansion seat (D), follows a mated groove on the inside of the sub, thus centering the valves (G) with respect to the valve seat plate (H). The mechanism is then made fast with a snap ring and three set screws that bind the expansion seat (D) to the sub wall. A short top sub then encloses the mechanism. Over-all length is 3.96 ft.

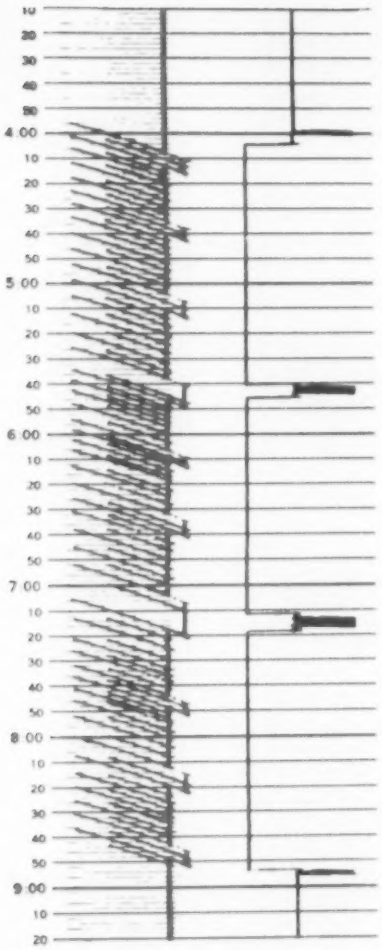
As the fluid flows through the sub, the valve carrier plate (F) is forced down seating the valves (G) in three of the six water courses. The cam (B) is grooved so that, as it glides along the cam followers (A), it rotates 60°. When the mud pump is idled, and rotary table stopped, the decrease in mud velocity permits the compressed rod spring (C) to expand. This causes the valve carrier plate to assume the neutral position.

By using the three-valve carrier plate (K), the efficiency of the jet nozzles is compared with the 11/16-in. conventional water courses in the bit.

By using the two-valve carrier plate (L) and positively plugging off the water ports leading to the conventional water courses in the bit, three jet combinations are possible using two nozzles at a time.

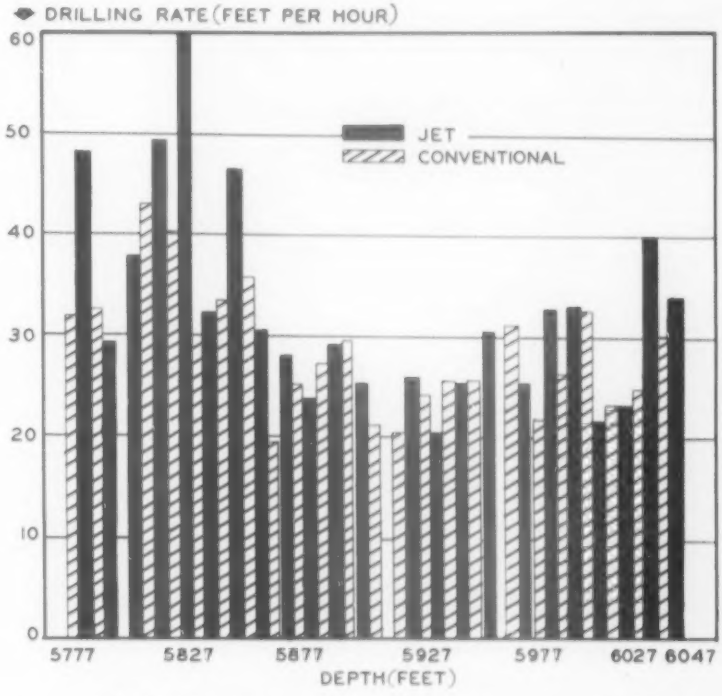


INDEXING SUB used in jet bit tests. Fig. 1.



GEOLOGRAPH RECORD for a variable formation. Fig. 2.

This article reports drilling-rate results obtained with a special sub above the bit which varies bit hydraulics during a single run into the hole. With this sub, rates can be compared for narrow depth intervals in the same hole where bit weight, rotary speed, bit and drilling mud do not change.



DRILLING RATE as a function of depth for variable formation. Fig. 3.

Reveals Effect of Bit Hydraulics

. . . in hard-rock drilling

by R. J. Bromell

entire well. Many points are missing from the higher horsepower ranges because of missing a run. Few rigs can provide the horsepower needed to complete the 200 to 300-bit-horsepower curves. If these rigs are not drilling under the same conditions of weight, rotary speed, and mud characteristics as the other rigs, it is impractical to correlate the data. These facts are mentioned to emphasize the difficulty encountered in selecting the well and waiting for all the variables to be right before the sub could be run.

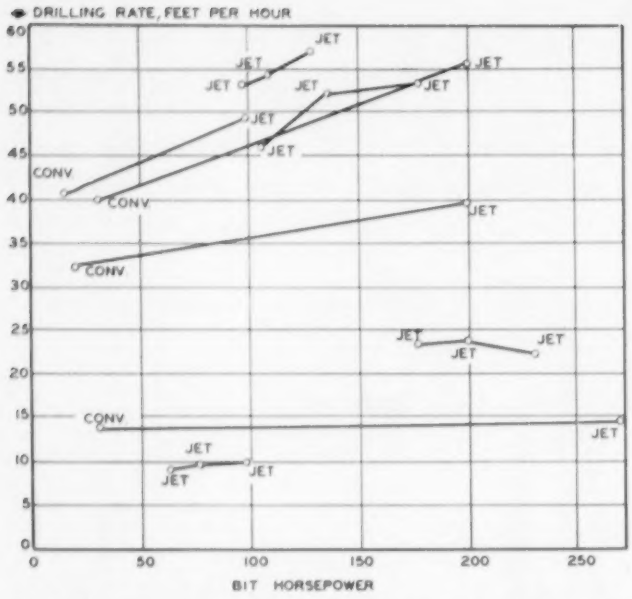
Recording data . . . When all the requirements of mud, bit weight, rotary speed, nozzle sizes, and bit type were met, the sub was ready to run. An engineer stayed throughout the run, timing each foot and recording other related data. On long runs two engineers were used.

During the taking of data, the sub was switched every 3 to 10 ft. depending upon the drilling rate and thickness of the zone being checked. Comparison of jet vs. conventional water courses was made with various circulation rates and nozzle sizes. After numerous runs with flow alternating from jet to conventional water courses, a series of tests were made with changing nozzle sizes. A special setting of the sub is required for this type work.

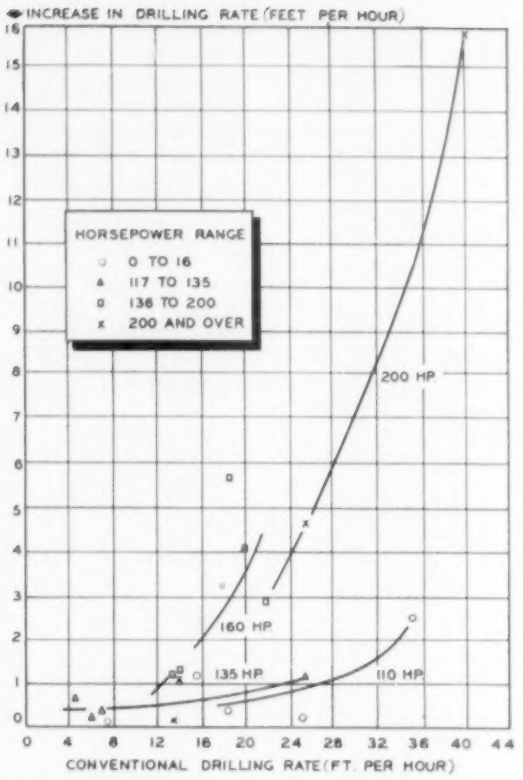
Relatively few runs have been made using the variable-nozzle-area arrangement. However, the information obtained is consistent and appears to be reliable.

Lost-circulation material in the mud or any one of several other things could cause a failure in the switching mechanism of the sub. From the description of how the sub is prepared for operation, it is obvious that a misrun often meant missing a long-awaited zone. Despite these limiting conditions, this committee report is based on over 3,600 ft. of hole drilled with the sub.

Results . . . Specific data and charts have been selected from the most uniform sections. With the data collected,



JET VERSUS CONVENTIONAL drilling rates for different bit horsepowers. Fig. 4.



DRILLING RATE versus change in drilling rate for varying bit horsepower. Fig. 5.

it is possible to illustrate many things about jet bits from the fact that they drilled 15 per cent slower than conventional bits to 40 per cent faster than conventional bits. Careful screening was necessary to select what are considered representative runs.

Of all the runs made with the sub only one case (35 ft.) indicated that conventional bits would outdrill the jet bits. When using the runs in their entirety it was observed that drilling rates changed by values of 0.26 ft. per hour to 15.7 ft. per hour. Although some changes in drilling rate were small, it should be noted that in every case except one, some increase did result from use of a jet bit.

In starting the tests a number of runs were made switching from conventional to jet water courses. This was to establish a "base penetration rate" from which to work. In other words, the drilling rate with conventional circulation was to be used for reference and all increases measured from the conventional rate. Rates were divided into several ranges and runs obtained in these ranges with various bit horsepowers. The ranges established were:

1. 5 to 10 ft. per hour.
2. 10 to 15 ft. per hour.
3. 15 to 25 ft. per hour.
4. 25 to 35 ft. per hour.
5. 35 to 60 ft. per hour.

Relation to conventional bit . . . Fig. 4 shows typical changes in drilling rate

TABLE 1

Point	Depth (ft.)	Jet-bit horsepower	Drilling rate — Conventional	Drilling rate — Jet	Circulation rate (g.p.m.)
5 to 10 Ft. per Hour					
1	10,018-10,026	135	5.8	6.0	385
2	10,035-10,043	135	4.5	5.1	385
3	10,403-10,453	135	6.9	7.2	380
4	7,677-7,691	98	7.3	7.4	362
10 to 15 Ft. per Hour					
5	8,022-8,063	240	13.7	13.8	376
6	6,137-6,188	163	13.5	14.7	380
7	5,455-5,480	270	13.6	14.75	410
8	4,447-4,485	138	14.15	15.45	360
9	6,901-6,963	190	22.1	25.0	360
10	6,742-6,768	116	18.15	21.4	448
11	8,050-8,109	147	20.2	24.3	405
12	6,818-6,843	116	18.35	18.66	448
13	6,794-6,900	115	15.7	16.8	450
14	5,173-5,196	166	18.7	24.4	345
25 to 35 Ft. per Hour					
15	5,832-5,862	110	35.4	37.9	370
16	5,868-5,910	130	25.8	26.9	360
17	6,302-6,392	200	25.7	30.4	450
18	6,761-6,791	102	25.2	25.4	360
35 to 60 Ft. per Hour					
19	6,285-6,323	200	40.5	56.3	370

THE AUTHOR

R. J. Bromell is chief drilling engineer for Great Western Drilling Co. Bromell was graduated by the University of Oklahoma in 1950 with a B.S. degree in petroleum engineering. He worked as production engineer with Phillips Petroleum Co. for a short time. He then became affiliated with Great Western as drilling engineer until 1954. This report was given at the 1956 spring meeting of the Southwestern District of the A.P.I. Division of Production, Fort Worth, under the title of "Bit Hydraulics for Hard-Rock Drilling."

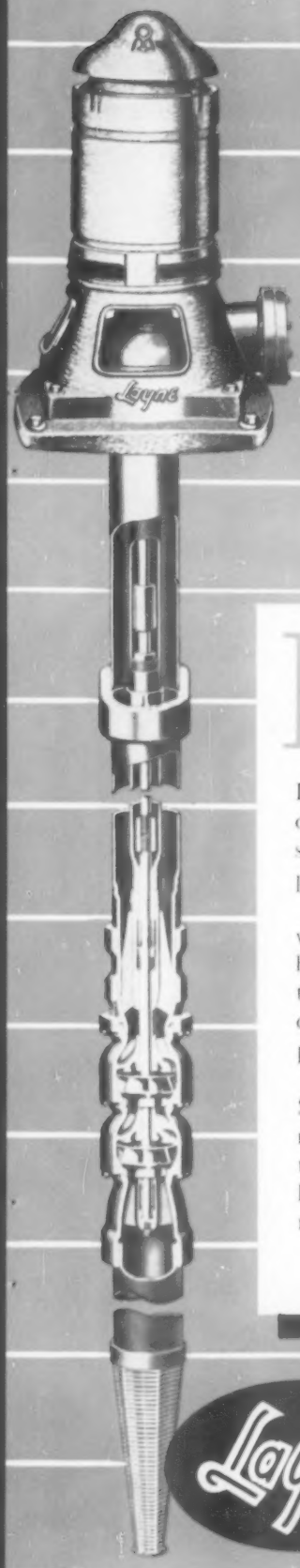


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TABLE 2

Weight (1,000 lb.)	Bit horsepower	Drilling rate (ft. per hour)	Circulation rate (g.p.m.)	Size nozzle (in.)
50	107	28.7	362	½ and $\frac{9}{32}$
70	107	48.7	362	½ and $\frac{9}{32}$
50	134	26.8	362	$\frac{7}{16}$ and $\frac{9}{32}$
70	134	52.2	362	$\frac{7}{16}$ and $\frac{9}{32}$
50	176	29.2	362	$\frac{7}{16}$ and ½
70	176	53.3	362	$\frac{7}{16}$ and ½

TABLE 3

Surface pressure	Circulation area (g.p.m.)	Nozzle area (sq. in.)	Nozzle velocity (ft. per sec.)	Required engine horsepower	Bit horsepower	Drilling rate (ft. per hour)
1,125	345	0.488	230	340	90	41.3
1,150	410	0.620	215	440	95	41.9
1,025	295	0.359	265	260	100	41.7

going from conventional to jet mud courses for each drilling range. With only two points for each run, the curves are drawn as straight lines. The slope of the curves increases as the drilling rate increases, indicating greater benefits at higher penetration rates.

Table 1 shows more of these data obtained with a wide range of jet-bit horsepower. Calculations are based on equations given in the Hughes Tool Bulletin No. 1-A.

Fig. 5 shows the increases obtained by the use of jets and shows the general effect of bit horsepower at the various "base penetration rates."

When drilling rates are below 26 ft. per hour little advantage is to be had with jet bits if the bit horsepower is not over 110. No significant increase was noted even at 270 bit-horsepower until a penetration rate of approximately 15 ft. per hour was reached. Some response was obtained with 160 bit-horsepower above 14 ft. per hour.

There is apparently a sharp rise in the effect of bits at about 160 bit horsepower between 15 and 20 ft. per hour. Scatter in the data makes the exact position of the upper end of the 160-hp. curve rather vague. More runs would be necessary to firmly establish the remainder of the curve as well as to fix the exact position of the 200-hp. curve. Both the 110 and 200-hp. curves indicate a rapid increase in drilling rates by jet bits at the higher "base penetration rates." However, the curves are based on a limited number of runs. More tests would be needed to completely define these curves and make them more reliable.

Varying nozzle area . . . Four runs, also illustrated in Fig. 4, utilized the sub with variable jet nozzle area. All but one of these runs conform to the curves in Fig. 5. This one exception showed a decrease in penetration rate as the bit horsepower was increased to 252 hydraulic horsepower. It was noted, however, that the added load on the engines caused a decrease of 2 r.p.m. from 58 to 56 r.p.m. Apparently at this drilling rate the loss of 2 r.p.m. on the rotary table was far more important than the additional 52 bit horsepower.

Table 2 shows the effect of high bit weight on drilling rates. This formation was obtained to illustrate the difficulty in correlating information if the drilling conditions are not the same.

Only one attempt was made to determine the effect on drilling rates when the bit horsepower is kept constant and the fluid volume varied. The results of that test are as shown in Table 3.

One test is by no means conclusive, but it does indicate that within limits nozzle size can be reduced and fluid volume decreased, thus reducing the parasite loads in the circulating system. Note that approximately the same bit horsepower resulted in the same drilling rate, yet the engine power was 180 hp. less in the low range of fluid circulation as compared to the high rate.

Adequate cleaning of holes has been maintained with annulus velocities as low as 90 ft. per minute when drilling at approximately 100 ft. per hour. Normally, annulus velocities should be higher than 90 ft. per minute for best results.

Acknowledgments

The committee wishes to express its appreciation to the following men for their help in obtaining and interpreting the data presented in this paper: S. T. Crews and Paul Green, Hughes Tool Co., and W. A. Sitko, Great Western Drilling Co., all of Midland, Tex.

The committee would also like to express its appreciation to Hughes Tool Co. for furnishing the indexing sub as well as paying the expense involved in using this sub.

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Nelson Refinery Construction Index

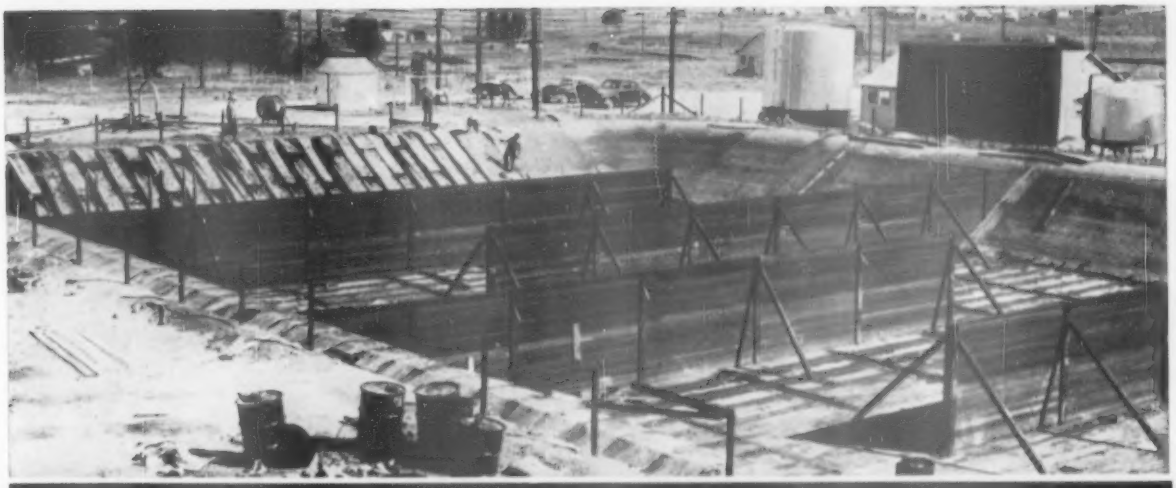
Appears in the Engineering Section in the first issue each month.

Compiled by W. L. Nelson, petroleum refinery consultant, Tulsa.

The Index was explained July 7, 1952 (page 105) as well as the Indexes of Individual Items of Equipment that appear on the Cost-imating page in the first issues of the months of January, April, July, and October.

	Index (1946 = 100)					
	1949	1952	1953	1954	1955	Jan. 1956
Pumps, compressors, etc.	135.9	155.6	162.5	166.5	172.2	181.4
Electrical machinery	130.9	152.4	156.4	160.0	162.5	167.6
Internal-combustion engines	124.8	146.5	148.1	150.5	153.2	159.7
Instruments	123.1	146.2	151.8	154.6	162.9	168.8
Heat exchangers	133.0	165.8	174.9	171.7	156.8	162.9
Miscellaneous equipment average	*121.6	153.3	158.8	160.7	161.5	168.1
Materials component	143.6	164.3	172.4	174.6	176.1	184.7
Labor component	137.1	163.1	174.2	183.3	189.6	193.6
Nelson construction index	139.7	163.6	173.5	179.8	184.2	190.0

*Used in computing the Nelson Index until April 1952. This is slightly different from the average of the Miscellaneous Equipment Items shown above.



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Elsewhere in this issue, an article written by Al Gaston, of Al Gaston Construction Company, describes his experience with Gulf-Seal Linings in water-treating applications.

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WRITE FOR ENGINEERING BROCHURE

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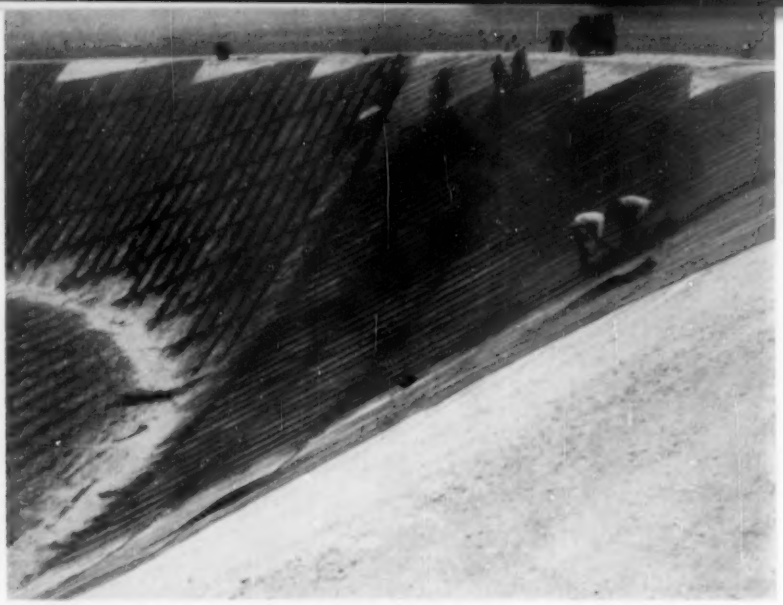
Here's a Fast Way to Seal Water-Storage Ponds . . .

by Al Gaston



1 FIRST STEP is excavation and shaping of storage pond. Heavy machinery packs the surface, then crews lay prefabricated asphalt sheets end to end, side by side over entire surface. (Water-storage reservoir at Big Spring, Tex.)

LOSS of water from open-type waterflood plants can be expensive both from the standpoint of loss of volume and from pollution where salt water is involved. For these reasons many operators are taking care to make their treating ponds impermeable. Presented here is the method of lining pits with prefabricated asphalt membrane. Advantages of this type of lining are:

1. Low cost—installed cost of ½-in. lingings ranges between 25 and 28 cents per square foot, much less than that of monolithic structures.

2. Impermeability—sheets are tough and will not crack and can stand rubber-tired equipment and cattle traffic without damage.

3. High density—specific gravity of linings is 1.2 which prevents their floating and eliminates the need of backfill.

Author is with Al Gaston Construction Co., El Dorado, Kans.

Where applied . . . The need for waterproofing of the water-treating system starts in the brine-collection pits. It extends then to aerating pond and ditch and to the settling pond. It also includes backwash pits.

When these waterways remain unlined, several problems develop. First, and most important, the surface and subsurface of areas are polluted. In addition, input water is wasted, sometimes to an important degree, by seepage. The pond and ditch surfaces are difficult to clean. The plant site becomes muddy. These problems are overcome by impermeable linings.

PRODUCING

How it's put on . . . Membrane construction of ponds and ditches is fast and simple. Bulldozers and heavy carry-alls first rough out the areas. Then sheeps-foot rollers or crawler machinery compact the excavated surfaces.

Slopes of all ponds should be no steeper than three to one. Large rocks and clods are removed. A berm, 8 ft. wide, should be formed around the edge of the pond. All pipes that come into the pond should be anchored to the berm in a concrete base to prevent settling.

In a typical installation such as those shown in the accompanying photos, the lining is made up of sheets

3 FINISHING THE SURFACE requires sheets to be brought up over berm and staked. Edges are then backfilled. No further earth fill is needed since linings will not float. Smooth surface at joints is obtained by repointing and filling with adhesive. (Ohio Oil Co. water flood at Eureka, Kans.).

4 AERATING DITCH also needs sealing. Large unsealed area could lose a lot of water. Here sheets overlap and are sealed together by adhesive. Repointing smooths the overlap. Edges are also staked and backfilled. (Murphy water-flood aerating ditch, Cities Service Oil Co., El Dorado, Kans.)

2 AS SHEETS ARE LAID DOWN, crews carefully clean all edges with power brushes. Adhesive is then mopped on joints and bonds 6-in. strips to form impermeable surface. (Salt-water storage pit in West Texas.)

½ in. thick, 3 ft. wide, and 12 ft. long. These sheets are precut at the factory.

. . . **Cleaning** the sheets at the edges and ends is important to making an impermeable joint between sheets. Large power brushes remove all dirt and foreign material. Then the sheets are placed end to end, side by side over the entire floor and walls of the pond.

. . . **Sealing the joints** is done by ¼-in.-thick, 6-in.-wide covering strips which are of the same material as the sheets. The joint areas and the covering strips are both hot-mopped with a special adhesive and the strips are then placed on the joint. Foot pressure completes the bond. The right-angle edge between the trip and sheet then is filled in by repointing and hand application of adhesive.

In ditches, a somewhat different method is used. The sheets are overlapped 3 in. on the sides and 6 in. on the ends. Both top and bottom surfaces of the joints are hot-mopped with the adhesive and then the edge is repointed, to form a relatively smooth surface.

Anchoring . . . In both ponds and ditches the material must extend over the berm and be anchored by stakes into the berm. The edges of the sheets, only, are backfilled. In some unusual cases, however, where high wind velocities or torrential rains are likely to be encountered, the entire sheet over the berm should be backfilled.

Since these asphalt linings have a specific gravity of 1.2, there is no possibility of their floating. No backfill in walls or bottom of the ponds is needed.

The material is tough enough to allow rubber-tired equipment to travel over it and is not damaged by cattle traffic. Should the linings be perforated or torn after installation, the tear is repaired easily with a patch.

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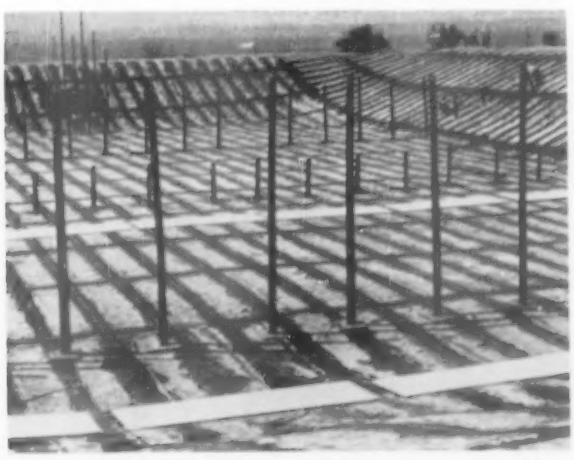

5 IN SETTLING POND, these poles form support for asbestos baffles. Base of poles is sealed to lining. Water passes under the first baffle, over the second and under the third to collection point. (Settling pond, Reece, Kans., water flood, Tide Water Associated Oil Co.).

6 COMPLETED POND, now filled with brine, is leakproof. Impermeable lining prevents pollution of surrounding area, muddying of surfaces, and saves flood water. Top of last baffle shows with floating water pickup line in the background. (Settling pond, Reece, Kans., water flood, Tide Water Associated Oil Co.).

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Selected Digests . . .

. . . of papers presented at the joint annual meeting of the American Association of Petroleum Geologists and the Society of Economic Paleontologists and Mineralogists, Chicago, April 23-26, 1956.

"Factors Relating to Fault Seals in Some California Oil Fields

ALBERT F. WOODWARD, Union Oil Co. of California, Whittier, Calif.

THE fault-seal problem in California is reviewed with particular reference to multizone fields. Fault seals are of importance not only as barriers to migration of oil and gas in fault-trap fields but also are very important as secondary traps in most anticlinal closures in California.

The sealing effect of faults has complicated the field development, reservoir studies, pressure maintenance, and secondary-recovery programs in multiblock, multizone fields. Several factors which influence the effectiveness of fault seals include (1) type of faulting, (2) lithology of sediments, (3) time of faulting versus accumulation, (4) depth of burial during faulting, (5) magnitude of fault displacement, (6) secondary cementation along fault planes. The effect of these various factors will be discussed as they relate to fault accumulations in various California fields.

The influence of postaccumulation faulting has played an important role in pool separation and pool readjustment. Pressure barriers resulting from fault seals have caused abnormal reservoir pressures in some fields. Major fault systems in the state can be related to the local field fault pattern in many areas. The analogy has aided in the exploration for new fault-block accumulations within a proved field area as well as exploration for new fields.

Sealing Factors for Non-Structural Paleozoic Oil in the Paradox Basin of the Four Corners Region

SHERMAN A. WENGERD, University of New Mexico, Albuquerque.

DISTRIBUTION of oil in the San Juan basin, both geographically and stratigraphically, proves it to be intimately related to rapid vertical and lateral facies changes along the edge of the Paradox salt lentils and basinward of the sedimentational feather edges of Paradox gypsum; to the vagaries of dolomitization in the postsalt strata on the Dove Creek "high"; or to complex vertical migratory factors in lower Paradox beds related to sealing by salt flowage in the Cane Creek-Big Flat area in southern Grand County, Utah.

Commercial oil has been found in Mississippian carbonates with intercrystalline porosity, sealed by "tight" carbonates and thin shales, fortuitously located on Laramide anticlines in the northwestern San Juan basin, itself a southerly shelf of Paradox geosyncline. Minor amounts of oil have been found in Rico-Hermosa arenaceous limestones showing great variation in lateral porosity, hence sealed in the strata by their own sedimentary variations rather than by inflicted postmigratory sealing factors.

Between these two oils enumerated above, virtually the entire proved petroleum potential of the Paradox basin lies within the upper member of the Paradox formation of Cherokee (early Des Moines) age.

These Pennsylvanian oils have been found in gypsiferous dolomite, calcareous dolomite, argillaceous dolomite, dolomitized calcarenite of possible biohermal and biostromal origin, calcareous sandstone, and in solution porosity developed along disconformities in carbonates outside, at, or just inside the Paradox salt wedges. The seals which hold these accumulations in anomalous structural positions are directly related to sedimentary variations involving gypsum, dolomite, gray and black shale, and siltstone.

Mississippian Oil Fields of Northeastern Williston Basin

WALTER JOHNSON, Sohio Petroleum Co., Billings, Mont.

ANHYDRITE seems to be the most important factor in forming the seals for Mississippian reservoirs in the northeastern portion of the Williston basin. There are at least three methods by which anhydrite helps to seal the reservoirs of this area.

First, secondary anhydrite along the unconformity at the top of the Madison forms an impervious zone of variable thickness by filling the fractures and pores of associated rocks.

A second type of seal is created by primary anhydrites interbedded with porous, often vuggy, fragmental limestones. The angle between the unconformity and bedding is small so the primary anhydrites often help to form the seal along the weathered area.

A regional facies change, in which porous reservoir beds grade to dense anhydrites in an easterly direction, as the basin edge is approached, is a third type of seal.

This paper, covering a small portion of the Williston basin, is confined to a series of relatively new fields discovered in southeastern Saskatchewan, extreme southwestern Manitoba and North Central North Dakota. All produce from the Madison limestone of Mississippian age and all have one or more of the sealing factors.

Normally, the Madison limestone is divided into Lodgepole, Mission Canyon, and Charles. The Charles represents an evaporitic stage at the end of Madison deposition. Mission Canyon and Charles both represent a cyclic deposition referred to in other published papers on the Madison limestones. The oil fields mentioned in this paper produce from the Mission Canyon and Charles sections. By detailed analysis, it can be shown that individual beds of limestones on the basinward side completely change laterally first to fragmental limestone with algal pisolites, then finally to dense anhydrites near the edge of the basin.

If the term Charles is used, it represents much older beds on the basin edge than are found farther into the basin. This condition is very easily demonstrated in an east-west direction. In a northerly direction, the condition does not exist to such a degree because the unconformity truncates the section at a rate faster than the facies change so the evidence is lost. Since Charles-Mission Canyon terminology is not suitable here, the subdivisions proposed by the Saskatchewan Geological Society, MC 1, 2, 3, 4 and 5, and C-1, C-2 will be used.

Oil fields, to date, have been confined to structural noses with little or no reversal, but having the anhydritic weathered zone or facies change as an updip seal.

EXPLORATION

Petroleum Sealing Factors in the Western Canada Sedimentary Basin

WILLIAM GALLUP, Royalite Oil Co., Ltd., Calgary, Alta.

THE phenomena which give oil its tendency to move toward surface are touched upon and the conditions which restrict this movement are presented: First, oil has certain chemical and physical properties and behaviors which tend to reduce migration and become to an extent a seal, particularly in the early life of a pool or during a period of truncation. Secondly, a seal, in this case a geological seal, is seen as a function of the entire geologic history of a pool. It is a sequence of events and not merely a cap rock or some specific geologic condtion.

Examples are taken from four systems: Devonian, Mississippian, Jurassic, and Cretaceous. In each case the geologic history of the pool is interpreted to demonstrate that the geologic events from before deposition of the reservoir rocks, were designed to accumulate the oil and seal it in place. This sequence of events will be fairly constant for any system in any geologic province and somewhat anomalous to the regional geology of that province.

Carbonate Cementation as a Sealing Factor in Oil Accumulation, Southwest Virginia

RALPH L. MILLER, U. S. Geological Survey, Washington, D. C.

ENTRAPMENT of oil in commercial quantities in the folded faulted rocks of the folded Appalachian province has been demonstrated at Rose Hill in Southwest Virginia. The oil occurs in fractured limestone of Trenton age beneath a folded major overthrust fault, the Pine Mountain overthrust. Movement of the overriding rocks along the Pine Mountain fault has been between 5 and 6 miles in the vicinity of the oil field.

The productive area of the Trenton limestone seems to be confined to a structural terrace beneath the overthrust where the overridden rocks are nearly flat-lying or gently dipping but without reversal. To the northwest the Trenton and enclosing rocks descend several thousand feet in a regional syncline, the Middlesboro syncline. To the southwest they rise and are truncuated by the Pine Mountain fault plane.

Presently known productive zones in the Trenton limestone lie from 800 to 1,500 ft. beneath the overthrust fault. Southeast of the field, dry holes have been drilled into the Trenton at locations that are structurally higher than at the producing field and are nearer the Pine Mountain fault where fracturing of the overridden limestone would be expected to be most intense. Thus the seal to the reservoir is apparently neither im-

pervious rock in the overthrust sheet that lies upon the truncated edges of the Trenton nor impervious fault gouge along the overthrust. A seal of a different nature must exist farther downdip, for the oil otherwise would have migrated to the highest structural location beneath the fault and would locally have escaped to the surface in fensters where the oil-bearing beds of the Trenton are exposed by erosion.

Cementation by carbonate minerals from circulating ground waters is postulated to account for the impervious nature of the fractured limestone and dolomite updip from the oil pool. Migration of the oil to its present location not only followed the folding and overthrusting of the Appalachian orogeny but followed precipitation from water circulating along the most open channels and the resultant cementation of the fractured and brecciated rocks.

Numerous possibilities for fault traps exist in the central and southern Appalachian. If cementation is a common sealing factor in fractured or otherwise pervious and porous rocks near Appalachian overthrust faults, oil may occur along pervious and porous zones downdip beneath the faults near Rose Hill or elsewhere but may be absent at or near the fault seal in the same areas.

Nature of Porosity and Permeability In the Edwards Formation, Texas

DAN E. FERAY and HENRY F. NELSON.

THE Fredricksburg group of the Lower Cretaceous in Texas consists of the following formations:

Kiamichi shale, Edwards limestone, Comanche Peak limestone, Walnut formation, and Paluxy sand.

In the vicinity of the Red River, the Fredricksburg group consists predominantly of the Paluxy sand which is in part Fredricksburg and part Trinity in age. As the group is traced to the south, a regional facies change takes place which results in the Edwards limestone making up almost the entire Fredricksburg in the vicinity of Austin. The Kiamichi shale disappears in the vicinity of Waco as a result of nondeposition or erosion.

The Edwards formation consists of many types of fine to coarsely granular and crystalline nonfossiliferous limestones, fossiliferous limestones, cherty limestones, chalk, and finely crystalline dolomite. Locally, a rudistid facies comprises the entire Edward formation. Dolomite and crystalline limestones occur south of the pinchout of the Kiamichi. This distribution with respect to the Kiamichi, as well as the irregular shape and variable character of the secondary limestone masses, the extensive development of stylolites, concretions, intraformational breccias, and honeycombed limestones, is believed to be a result of weathering action which occurred during late Fredricksburg or early Washita time or both. The secondary processes of dolomitization, solution and redeposition of $CaCO_3$, have both increased and decreased the original porosity and permeability of the Edwards formation.

The relationship of porosity and permeability to stratigraphy, mineralogy, and lithology was investigated in five diamond cores from the upper 100 ft. of the Edwards formation in South-Central Texas. This investigation has shown that:

1. Dolomite is present in the Edwards where the Kiamichi is either thin or absent.
2. Porosity in the Edwards dolomite is intercrystalline.
3. The Edwards limestone has many types of porosity which may be high but the permeability is usually low.
4. In the cores, the permeability and oil production is largely confined to the dolomite.
5. All Edwards oil production is located where the Kiamichi formation is absent.

Classification of Porosity and Fractures in Reservoir Rocks

W. A. WALDSCHMIDT, P. E. FITZGERALD, and C. L. LUNSFORD.

THE porosity and fracture classifications discussed deal primarily with carbonate rocks; however, they are definitely applicable to other types of rocks. These classifications represent the results of a part of petrographic studies of reservoir rocks conducted for Dowell Incorporated, Tulsa.

The carbonate rocks are divided into five major groups on the basis of porosity, namely: (1) nonvuggy; (2) vuggy, no filling; (3) vuggy, partly filled; (4) vuggy, filled; and (5) fossiliferous. The latter is divided into three parts, depending on the nature of fossil shells, particularly of fossils such as fusulinids and other small-celled forms. These three subdivisions include: (A) unbroken shells; (B) broken shells, that have been "healed" by carbonate deposition; and (C) shells whose original structure has been essentially or completely destroyed by recrystallization of the carbonate composing them. In all five major porosity groups, the intercrystalline porosity of the matrix is estimated as to quality, ranging from very good to very poor.

Fractures are divided into four major groups, namely: (1) open; (2) partly filled; (3) filled; and (4) closed. Each of these four groups is subdivided on the basis of orientation of the fractures into: random; (B) vertical; (C) horizontal; (D) inclined; and (E) intersecting. The (A) random fractures are divided further into intersecting and nonintersecting; and (E) intersecting fractures are grouped into vertical-vertical, vertical-horizontal, etc. Also taken into consideration is whether the mineral grains in the partly filled and filled fractures are larger or smaller than those in the matrix.

The classifications of porosity and fractures are presented as a practical means of properly grouping these rock characteristics which are so important not only in connection with studies of oil and gas reservoirs, but also as related to general geologic investigations.

Problems of Carbonate Rock Porosity and Permeability

THEODORE A. LINK, Link, Downing & Cooke, Ltd., Calgary, Alta.

IF there were no porous or fractured rocks in the geological column a great deal less oil and gas would be found. However, since we know such is not the case, the petroleum geologist and engineer is quite interested to learn as much as possible about the characteristics of the various types of porosity and permeability in the known and the possible rock reservoirs of the earth.

The sand or sandstone reservoir is one of the more simple types, and if there were a sand reservoir in which all the grains were spheres of uniform size it would be the ideal type of encounter. Such is never the case, since sand grains vary in size and shape locally and regionally and to this are added such factors as cementation, fracturing, etc.

Due to the diverse means and ways of the deposition and accumulation of carbonate rocks, and the formation of carbonate rock reservoirs of almost unlimited variations of porosity and permeability, their interpretation and understanding are not always as simple. Unfortunately things are further complicated by the diverse opinions of the geologists who, though capable of making identical observations, often arrive at divergent interpretations.

Brief mention of some of the various phases and environments during the accumulation of carbonate rocks, and what can happen to them subsequently, will be made. Specific problems will be described and attacked by the several able contributors to this symposium on "Porosity and Permeability of Carbonate Rocks."

Dolomitization in Relation to Porosity in Carbonate Rocks

LESLIE V. ILLING, consultant to Shell Oil Co., Calgary, Alta.

THE common assumtpion that dolomitization always creates porosity and permeability is challenged. All three are end products of complex diagenetic changes which are largely governed by the nature of the original carbonate sediment. The paper focuses attention on the latter aspect of the problem.

There is little agreement on how dolomite is formed in nature, how far it is primary, and how far it is secondary. Widespread dolomitization involves partial replacement of lime by magnesia, for which the overlying sea water has been regarded as the logical source. This seems likely in the case of lime muds thought to have formed in shallow hypersaline seas where dolomitization began soon after deposition (penecontemporaneous); but in secondary dolomitization, connate water expressed by compaction under the load of later sediments or by tectonic movements is considered a more probable agent. Its lower Eh, higher pH, and different chemistry (e.g. lack of sulfates) compared with sea water are possible factors in inducing such diagenetic changes.

The total quantity of fluids squeezed out depends on the compactibility of the sedimentary pile: the movement and distribution of the fluids are controlled by variations in permeability. Paths of relatively higher permeability, such as beds of lime sand or reefs, create escape routes for compaction fluids and are therefore more likely to be dolomitized than surrounding lime muds. Thus, in open marine fossiliferous limestones with a matrix of lime mud, dolomitization is generally subordinate apart from such interstratified more permeable beds.

Lime sands and coarser bioclastic sediments such as shell banks and reefoid limestones have high initial porosity and permeability which are reduced during burial by cementation and limited compaction. In biothermal accumulations, further settling after lithification due to differential compaction of the surrounding sediments may cause autobrecciation, reducing porosity but maintaining or even increasing permeability. The fractures aid the permeation by magnesia-bearing fluids, and the rocks are dolomitic because they are fractured rather than the reverse.

Dolomitization along fault planes tells the same story. In most cases, dolomitization of such sediments leads to an increase in permeability, but the reverse is possible. The effects on porosity are still more variable. Selective leaching of aragonitic skeletal grains and recrystallization and dolomitization of the intervening matrix produce vuggy porosity.

Intercrystalline porosity depends on the distribution and degree of intergrowth of the dolomite crystals, and hence on the composition and fabric of the original sediment, the availability of magnesia, and the sequence of associated diagenetic changes involving recrystallization, calcification, leaching and cementation. The best permeability produced by dolomitization occurs where it creates a

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framework of crystals from between which residual calcite is removed by leaching.

Examples from Canada and Mexico are presented to support the thesis that secondary dolomitization follows permeability rather than creates it.

Superposed Geologic Data As An Exploration Tool

CLAUDE W. SHENKEL, JR., Kansas State College.

THE successful seeker for new petroleum reserves must be guided by careful and detailed analysis of geologic conditions occurring in areas of known petroleum accumulation. Superposition of stratigraphic and structural features on a single map can be employed to (1) facilitate analysis of the complex geologic framework associated with the accumulation of petroleum, (2) integrate diverse factors in regional geologic evaluation, and (3) reevaluate structures that have been drilled.

Areas of petroleum accumulation, outlined by drilling, often can be defined by a series of superposed geologic situations. The superposed factors that will define an area of petroleum accumulation will vary as the geologic framework changes, hence, the factors to be superposed must be chosen only after careful consideration and experiment. Extension of the superposed components beyond the area of known accumuiation may reveal favorable areas for future exploration.

Some areas of proved petroleum accumulation in Utah, New Mexico, Colorado, and Kansas seem to be definable by superposed geologic data. Projection of these superposed components reveals areas that may be favorable for the accumulation of petroleum.

Sealing Factors in Oil Fields of Southwest Iran

S. ELDER, British Petroleum, Ltd., London.

A DESCRIPTION is given of the rock types which are known to obstruct the vertical or lateral migration of oil and gas, in particular the evaporites which have served as such an effective seal for the major oil fields. The effect of severe faulting and folding on the sealing capacity of these rock types is discussed and also the importance of overburden thickness.

A Different Stratigraphic Interpretation for the Trias-Permo-Pennsylvanian Sequence in Northern Wyoming and Adjacent Areas

ARTHUR C. MUNYAN, Sohio Petroleum Co., Billings, Mont.

FACIES changes within the Trias-Permo-Pennsylvanian have posed many stratigraphic problems in Wyoming and surrounding areas. A large proportion of these complexities have arisen from diverse conclusions resulting from conflicting lines of evidence provided by fossils in opposition to lithology. A principal controversy has centered on the presence or absence of major unconformities between the Dinwoody and Phosphia, and between the Phosphoria and underlying Tensleep.

Recent investigations have supplied data which may be interpreted to imply that no systemic hiatuses separate the three formations. It can be shown that the Triassic Dinwoody does not truncate the Permian Phosphoria but merges with it in northern Big Horn basin. In places this Dinwoody-Phosphoria equivalent seems to rest directly on Tensleep sand without disconformity.

Furthermore, at the Sage Creek Unit, Wyoming, interfingering of Phosphoria-type carbonates with Tensleep sands has been noted. This and the fact that there is compensatory thickening and thinning of the Phosphoria-Tensleep strata lends support to the contention of at least partial synchroneity of these formations.

Some Problems Concerning Sealing by Jurassic Anhydrite in the Persian Gulf

R. M. RAMSDEN, Iraq Petroleum Co., Ltd., London.

IN a continuously shallow sea a succession of limestones and anhydrites accumulated during part of the Jurassic in what is now known as the Persian Gulf area. The limestones have acted as source and reservoir rocks and the anhydrites as seals.

A description is given of the supposed mechanism of preservation of organic remains by strong brine in the limestones immediately preceding the deposition of anhydrite. The growth of stylolites in these limestones is suggested as the major cause of subsequent migration of fluids into anticlines and elsewhere between and beneath the seals. Sealing of hydrocarbons in individual dolomite crystals is also discussed.

Faults as Sealing Factors and as Channels for Migration of Fluids In Intermontane Basins of Wyoming

JOHN R. FANSHAWE, consultant, Billings, Mont.

PRODUCING structures in the intermontane basins of Wyoming are usually asymmetric anticlines with the steeper limb towards the basin rim. Characteristically, these folds have an axial high-angle reverse fault which diminishes in throw upwards, usually involving the Paleozoic section and changing to a draped fold stratigraphically above this point. The younger the surface formations, the less intense the folding appears to be.

The key example of this kind of "basin mechanics" is the Rattlesnake anticline on the west flank of Big Horn basin. This structure has the pre-Cambrian basement upfaulted against upper Madison beds in outcrop, and against the Tensleep sandstone in reconstruction. The details of the structural mechanics can be appreciated in the area due to the breaching of the structure by erosion.

In many cases, this fault situation acts as a seal, or barrier, against the downward-moving artesian waters from the outcrops along the adjacent uplifts. In some cases, the axial fault has acted as a channel for the migration of petroleum into reservoir beds, and occasionally into beds that do not normally carry petroleum.

Elk Basin field is taken as the norm, wherein the fault has simply acted as an additional sealing factor for the anticlinal closure. Bonanza field is a case wherein the fault is principaliy responsible for the presence of petroleum in the Tensleep reservoir at a structural altitude higher than is normal for the region.

Lance Creek field is taken as an example of early migration of petroleum via fault channel. In this case, the petroleum has migrated into a reservoir normally containing crudes of different gravity and quality and the presence of the fault has prevented later hydrodynamic flushing.

Wertz and Lost Soldier fields are similar to Lance Creek in the role played by faulting, but with the additional factor that petroleum has been introduced into the basal Cambrian sand which immediately overlies the basement.

This situation of axial faulting beneath an asymmetric anticline should cause a reexamination of gentle structures wherein increased downward intensity of folding may be expected. The possibility of earlier fluid migration along these axial faults opens up new horizins for prospecting in all reservoir rocks down to the top of the pre-Cambrian, in duplication of the situation found to be productive at Wertz and Lost Soldier.

Effective Seals Above Chester Sandstones of the Eastern Interior (Illinois) Basin

DAVID H. SWANN, Illinois Geological Survey. Published by permission of the chief, Illinois Geological Survey.

MOST lower Chester sandstone reservoirs are not effectively sealed from the next overlying sand units by 20 to 50 ft. of shale unless the shale contains at least 5 to 10 ft. of limestone. The limestone itself is probably not the seal but is rather an indicator of the type of shale most effective as a seal. The lower sandstone of a sandstone-limestone sandstone trio is unproductive in areas where lithofacies maps of the entire trio show clastic ratios greater than 8 to 16, unless the sand-shale ratio is less than one, or perhaps one-half.

The Aux Vases sandstone is overlain by the Renault formation, which in western Illinois generally contains shale with only traces of limestone and is overlain by Yankeetown (Benoist) sandstone. The Benoist is a prolific producer here. The Aux Vases carries water except at Salem field where an unusually large closure trapped oil in the Aux Vases and an intermediate Renault sand bed, as well as in the Benoist, resulting in the same water-oil contact in all three sands. In central to eastern Illinois the Renault (locally "lower Renault") carries more limestone, and the Aux Vases is extremely prolific. Examples of similar relationship can be found for most lower Chester formations.

Upper Chester reservoirs apparently are effectively sealed by thinner limestone-shale units, for there are several examples of pairs of sands with different oil-water contacts separated by shales less than 20 ft. thick that include only a foot or two of limestone. These upper Chester limestones tend to be darker and finer grained than the coarsely crystalline lighter-color lower Chester limestones, but there is little visible difference between the shales.

Unconformity Traps Around Piercement Salt Domes In South Louisiana

J. ROY JACKSON, JR., Humble Oil & Refining Co., New Orleans.

THE many piercement-type salt domes located in the South Louisiana portion of the Gulf Coast Salt Dome basin have long been a major source of new oil and gas reservoirs. Each year great new reserves are added to the nation's wealth as the extremely complicated geology of these domes is gradually unraveled by the continued solution of the complex problems of structure, stratigraphy, and sedimentation. Each piercement dome is an individual problem with its own unique geologic history and structure, each offering a challenge and requiring an individual solution to locate the reserves of oil and gas reservoired on and around the dome.

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The ROLOCHECK Meter has a zero minimum rate, and is available in working pressures from 150 to 1440 psi and capacities to 400 BPD.

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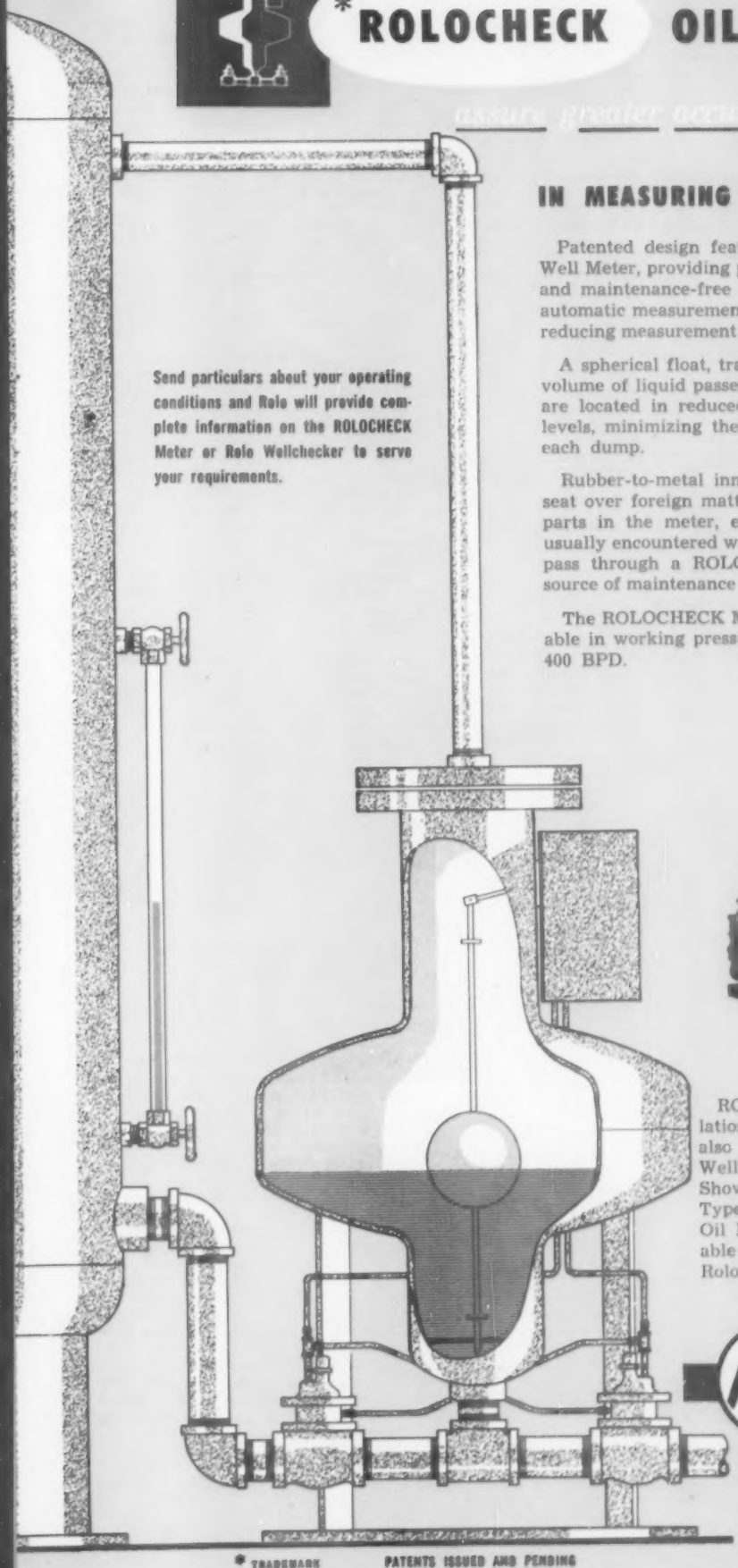

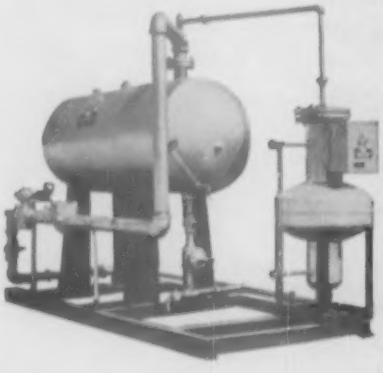

ROLOCHECK Meters are available for installation on existing separators or treaters, and are also now standard equipment on complete Rolo Wellcheckers, either skid- or trailer-mounted. Shown above is a skid-mounted Wellchecker, Type 4-1H-3000-24, employing a ROLOCHECK Oil Meter. These compact units are also available with Automatic Free-Water Knockout and Rolo Automatic Sampler.

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caused by radial and peripheral faulting, sand truncations against the salt stock or shale sheaths, traps under salt overhangs, etc., it has long been recognized that sands truncated and sealed by unconformities around the periphery of the domes account for important oil accumulations. Within recent years this type of trap has assumed added importance, and while it must be considered as secondary to the dome itself, the unconformity plays an important role in sealing off productive sands and can be classed as a valid oil trap in its own right.

Unconformity-type traps around piercement salt domes are difficult targets but will reward the venturesome operator armed with skillful and detailed interpretations of geological, geophysical, and paleontological data with worth-while discoveries. Some of the examples are at Avery Island, Clovelly, Bay St. Elaine, Lake Mongoulois, Lake Washington, Bully Camp, and Weeks Island domes.

Sealing Agents in the Olomos Sands Of Southwest Texas

J. E. GLOVER, Ohio Oil Co., San Antonio.

OIL and gas accumulations in the Olmos sands (Cretaceous Taylor) of Southwest Texas are primarily the result of entrapment by strike faulting, truncation, or permeability barriers. These factors are found singly or in combination. Until recently the strike fault with attendant lateral structural closure on the coastward side was the main exploratory objective, as dictated by experience.

Within the past 5 years new objectives have been added with the discovery and profitable exploitation of a number of Olmos oil fields of the stratigraphic type. These have been found at or near the updip limits of the three uppermost sand bodies, truncated at an angular unconformity basal to the overlying Escondido (Cretaceous Navarro) formation.

Shale is the effective sealing material involved, acting in one or more of three ways: (1) in contact with the faulted faces of the producing sands; (2) in contact with the beveled edges of the sands at their updip limits; or by filling the interstices of the sands, which often "shale up" near these limits.

Future of the Louisiana Offshore Oil Province as Predicted by Analysis of Its Onshore Counterpart

GORDON I. ATWATER, consulting geologist, New Orleans.

THE Continental Shelf of the Gulf of Mexico constitutes a new oil province by virtue of its geographic position and the special operating conditions that prevail in the area. Louisiana's offshore water bottoms are already established as the most important portion of this new oil province. This area is unique in that it is, geologically, an extension of the prolific Miocene producing trend located to the north in the marshlands of Louisiana.

Because of the fortuitous similarity in geological conditions between the offshore water bottoms and the adjacent marshland areas, it is possible to make, on the basis of the frequency and extent of the known commercial oil and gas fields in the already developed land areas, reasonable predictions of the success probability on undeveloped structures offshore.

However, the companies in their exploration of the virgin marine areas have so far searched for and leased only the larger structural features, commonly referred to as grade A prospects, and the initial exploration and development program will essentially be restricted to this type of structure.

A detailed analysis of all of the major structural features found in the Miocene trend of South Louisiana has been made in order to form a basis for predicting the future of similar prospects and fields that have been found and will be found in the offshore area. While selection of the major features eliminates less prominent structures, many of which account for major reserves in South Louisiana, it is believed that exploration and development of these less prominent features will constitute a later phase of development of the Louisiana Continental Shelf.

Onshore structures have been classified as piercement salt domes and as deep-seated structures, and a detailed analysis of success ratios, reserves, and reserves per well is given for these types of structures. The effects of the various geological, engineering, and economic factors that are peculiar to offshore exploration and development are integrated with the results of the onshore study, and the future potentiality of the water bottoms is discussed.

The application of this type of analysis to other new or future oil provinces is suggested.

Separation and Interpretation of Regional and Local Effects in Facies Maps

W. C. KRUMBEIN.

DISTINCTION between regional and local facies maps is commonly based on map scale, area covered, and tightness of control. An alternative manner of distinguishing between regional and local effects on maps of any scale can be based on the relative persistence of regional trends in cotrast to the lesser areal persistence of local fluctuations. The regional trends reflect broad tectono-environmental controls on sedimentation, whereas the local fluctuations are commonly due to smaller scale environmental, structural, or preexisting topographic effects.

Principles underlying practical ways of separating regional and local effects on maps of any scale are illustrated by conventional graphic methods adapted from geophysical practice, as well as by a statistical method that permits more detailed study of regional gradients. A "synthetic map" prepared by adding known residuals to known regionals is analyzed to show that the components used in synthesizing the map may be reconstructed. Actual examples of analyzed facies maps suggest that the method may permit sounder interpretation and extrapolation of regional trends as well as suggesting local areas where exonomically important departures may occur from the regional facies patterns.

Sealing Factors

GILMAN A. HILL, Petroleum Research Corp., Denver.

ALTHOUGH such geological features as cap rocks, fault gouges, stratigraphic pinchouts and siltous, and other types of trap barriers are permeable to water in some degree, they can hold an accumulation of oil because of their wettability and entry pressure properties. The fluid that wets the surfaces of the mineral grains in the trap barrier can pass through the barrier at a rate proportional to the permeability, whereas a nonwetting fluid is trapped.

When two immiscible fluids are together in an aquifer, the capillary pressure is the difference in pressure across the interface of the two fluids and is proportional to the vertical distance through which both fluids have phase continuity. The entry pressure of a trap barrier is the minimum capillary pressure required to cause a nonwetting fluid to enter the barrier and displace the wetting fluid. Since the entry pressure increases as the radius of the pore spaces decreases, the entry pressure of the less-permeable fine-grained silts and shales becomes increasingly large. The basic condition for oil entrapment, therefore, is that the entry pressure of the trap barrier must exceed the capillary pressure of the oil column contained in the trap.

Under hydrostatic conditions the length of oil column that can be trapped under any cap rock or against any trap barrier is directly proportional to the entry pressure of that barrier. For example, the maximum length of oil column that can be trapped by a barrier consisting of about 230-mesh silt having a pore radius of about .001 cm. would be about 10 ft. (A 100-mesh silt with a 0.002-cm. pore radius will hold approximately a 3-ft. oil column; a shale with a 0.00003-cm. pore radius will hold approximately a 300-ft. oil column.)

If adiditional oil enters the pool, the increased oil column resulting in increased capillary pressure causes the oil to enter and pass through the barrier, thereby leaking out of the trap. Every oil trap, therefore, has a limited capacity which is determined by entry pressure of the cap rock and other trap barriers.

Hydrodynamic conditions, including the very mild gradients (1 or 2 ft. per mile) of low-relief areas, will greatly increase or decrease the capacity of a trap barrier to hold oil. For example, a 10-psi. drop in pressure across a barrier (fault, silt zone, cementation zone, etc.) can increase the trapping capacity on the leeward side of the barrier by 190 ft. of oil column.

Conversely, a similar hydrodynamic gradient in the opposite direction would decrease the oil trapping capacity to 190 ft. less than that which would be held by the barrier's entry pressure under hydrostatic conditions. The oil-trapping capacity of many stratigraphic and fault traps appears to be primarily controlled by pressure differences due to hydrodynamic conditions and secondarily controlled by entry pressure properties of the barrier.

Photogeologic Exploration in Covered Basin Areas

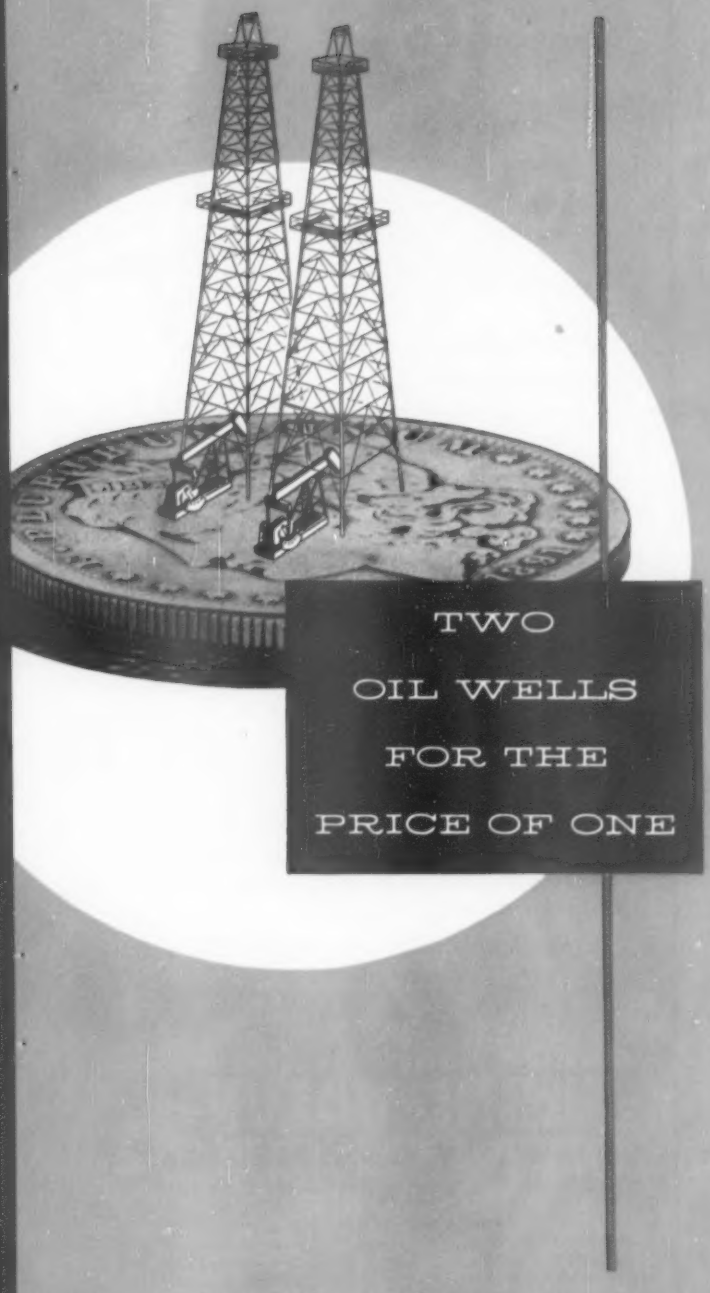
CHARLES DeBLIEUX, consultant, New Orleans.

PHOTOGEOLOGIC study has been proved successful as an exploratory tool in the Gulf Coast, West Texas, Denver and Anadarko basins, and the Canadian plains. Reflection of structure persists through relatively young sedimentary cover and is evident on the surface. A review of actual photogeologic studies in the several producing provinces is substantiated by evaluation in subsequent exploratory drilling.

Photogeologic anomalies are identified by subtle physiographic and geomorphic deviations from the normal as expressed in abnormal tonal and textural values. Color tone of the surface is determined by soil type and moisture content; texture is the product principally of sheet erosion and in coarser-grain stream erosion. The tonal and textural contrasts are the result of small relief differentials and are usually combined in producing the anomalous effects. Application of these criteria is demonstrated in Louisiana, Texas, Oklahoma, and Canada.

Confirmation of this technique is established in presentation of exploratory case histories of five discoveries credited to photogeologic interpretation.

A PROGRESS REPORT ON OILMASTER DUAL ZONE PUMPING EQUIPMENT



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by W. L. Nelson
Technical Editor

COST-imating

11. Depreciation Rates on Petroleum Equipment

(See Cost-imating No. 10, March 12, 1956, for Refinery Equipment)

COST INDEXES IN DRILLING AND PRODUCTION (1946 = 100)

	Oil-field machinery[3]	Rotary drilling costs[4]	Wages, production[6]	Nelson (Refinery) Construction Cost Index[2]
1946	100.0	100.0	100.0	100.0
1947	116.0	109.9	112.0	117.0
1948	125.9	122.0	127.3	132.5
1949	132.9	129.1	135.3	139.7
1950	135.8	137.4		146.2
1951	149.7	141.7	150.9	157.2
1952	149.9	144.0	162.1	163.6
1953	156.3	145.8	168.0 est.	173.5
1954	161.9	147.4	173.6	179.8
1955 est.	166.0	149.6	178.0	184.5

DEVELOPMENT EQUIPMENT, USEFUL LIVES, YEARS[1,5]

Boilers:	
Bad water	2
Good water	5
Oil field	8
Derricks:	
Steel	10
Wooden:	
Bolted	6
Spiked	5
Drilling equipment, well, cable tool	6
Drilling machines, well:	
Core	10
Portable	10
Rotary	8
Electrical equipment	10
Engines:	
Gas or gasoline	6-10
Oil	10
Generators and lighting equipment, electric	4-10
Motors	10
Pipelines, fuel, and water	4-5
Pumps, boiler feed or slush	4-8
Rig irons	5-10
Tanks, fuel and water, portable	8
Tools:	
Cleanout, cable	8
Drilling, cable	6
Fishing, cable	6
Water plant	10

PRODUCTION EQUIPMENT, USEFUL LIVES, YEARS[1,5]

Casing	20
Control head	15
Derricks, pumping:	
Steel	20
Wood	10
Dehydrators, electric	5
Dewatering apparatus, gas	15
Engines:	
Gas or gasoline	15
Steam	20
Jacks, pumping	10-20
Lift equipment, gas and air	6-10
Meters, field	10-25
Motors, electric	12-15
Pipes, flow lines	10-15
Power plants, well pumping	20
Pulling machines	8-10
Pumping units, electrical	20
Regulators, gas, field	10-25
Rods:	
Shackle	10
Sucker	3
Separators, oil or gas	10-15
Tanks, steel	12-20
Transformers and lines, electric	12-15
Treating plants	5-15
Tubing and packers	10
Vacuum plants, composite rate	8-15
Well and lease equipment as a whole	20

TRANSPORTATION EQUIPMENT, USEFUL LIVES, YEARS[1,5]

Barrels, steel	7
Marine equipment:	
Barges, tugs, etc.	5
Docks, bulkheads, etc.	4-6
Tankers	10-20
Pipelines:	
Gathering	10-11
High sulfur oils, tributary	10
Tributary	16
Pump stations:	
Gas	25
Gathering	16
Main line	25
Stations, distributing	10
Tank cars, railroad	20
Tanks:	
Concrete	33
High sulfur oil, steel	10
Ordinary oil, steel	20

MARKETING EQUIPMENT, USEFUL LIVES, YEARS[1,5]

Compressors, air, small	8-10
Marketing equipment, oil	16-20
Meters, gas	20-33
Pipe, gas-distribution lines	33-50
Pipe, main lines	20
Pumps, filling station	10
Racks, loading	12-20
Regulators, gas distribution	20-33
Tanks, storage:	
Horizontal, cylindrical	25-30
Underground	10-20
Service stations complete	25

References

1. Bulletin F., Bur. of Internal Revenue, U. S. Treasury Dept., Jan. 1942.

2. Nelson, W. L., Nelson Refinery Construction Index, The Oil and Gas Journal, July 7, 1952, p. 105. (The Nelson Index also appears in the first issue of each month.)

3. Wholesale Prices, U. S. Dept. of Labor, Bur. of Labor Statistics. (The indexes of 29 items of oil-field machinery are published each month.) Also see Nelson, W. L., The Oil and Gas Journal, Oct. 20, 1952, p. 187.

4. Am. Assoc. Oil Well Drilling Contractors. See Nelson, W. L., The Oil and Gas Journal, Jan. 9, 1956, p. 122.

5. Van Noy and Dunville, U. S. Bur. of Mines, Repts. Invest. 4534, Nov. 1949.

6. Survey of Current Business, monthly. In 1946 a weekly wage of $52.70 or an hourly wage of $1.309 (40.5 hours).

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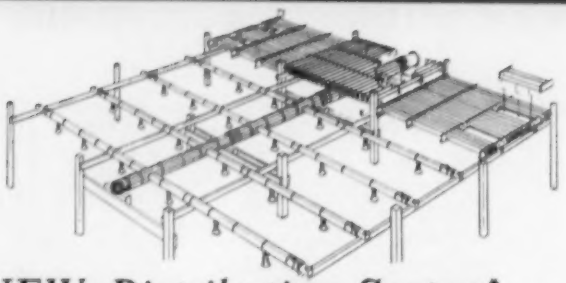

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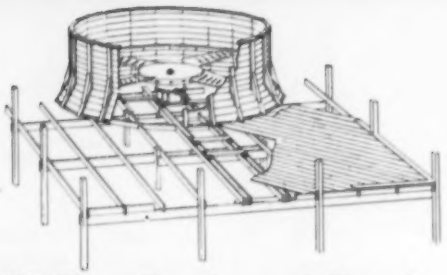

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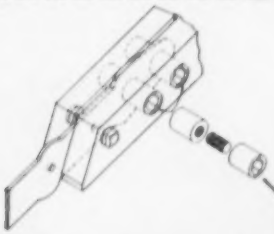

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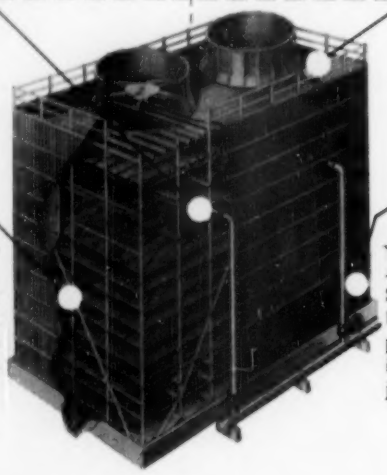

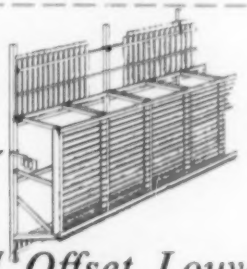

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REFINER'S NOTEBOOK

Contamination Index—1

Why the Contamination Index Will Prove Useful

by J. J. Watt,* B. G. Martin,† and W. H. Still*

A rapid, reliable, and safe means for detecting contamination of distillate burning oils with gasoline.

THE unique application of a combustible-gas indicator—an instrument which is standard equipment in petroleum refineries and terminals—has been developed. This instrument can rapidly and accurately detect contamination of distillate burning oils with gasoline.

Since 1948, Atlantic Refining Co. has successfully used the combustible-gas indicator for this purpose. Its use was developed by the laboratories of the product control department and the sales operations division of the domestic marketing department. It has been applied to the control of contamination at terminals in the operation of tankers, barges, pipelines, and tank trucks.

The problem and its significance . . . Contamination, when it occurs, can be very costly. Besides the direct costs of product degradation there are the intangible costs of lost sales. Contamination of distillate burning oils by gasoline could mean that the product would not be acceptable under local, state, or ICC regulations. This is because the flash point of a distillate fuel oil is markedly lowered by very small quantities of gasoline. The presence of gasoline in these products presents a potential hazard to the user.

The detection of, or the problems attendant to the contamination of, gasoline by distillate burning oil is a qualitative problem which will not be discussed in this article.

The possibility of product contamination is increased when mixed cargoes are used for bulk deliveries of products in tankers. The complexities of pipeline operations and the use of manifold systems at terminals and refineries also contribute to the possibility of product contamination.

Today, a large percentage of the bulk delivery of products is handled by tankers with capacities up to 250,000 bbl. These tankers are epuipped with several main cargo pumps and piping systems which are interconnected. It is common practice to load and discharge burning oils and gasoline simultaneously at a rate of more than 12,000 bbl. per hour. It is quite evident that a serious amount of contamination could take place in a very short time, especially at the discharge port.

The detection and control of contamination should be done without restricting or reducing the flexibility of the operations. Any increase in tanker turnaround time is costly.

Two laboratory tests commonly used for detecting small quantities of volatile materials in burning oils during the transfer of bulk deliveries are: (1) A.P.I. Gravity By Means of Hydrometer (A.S.T.M. D-287); and, (2) Tag Closed-Tester Flash Point (A.S.T.M. D-56).

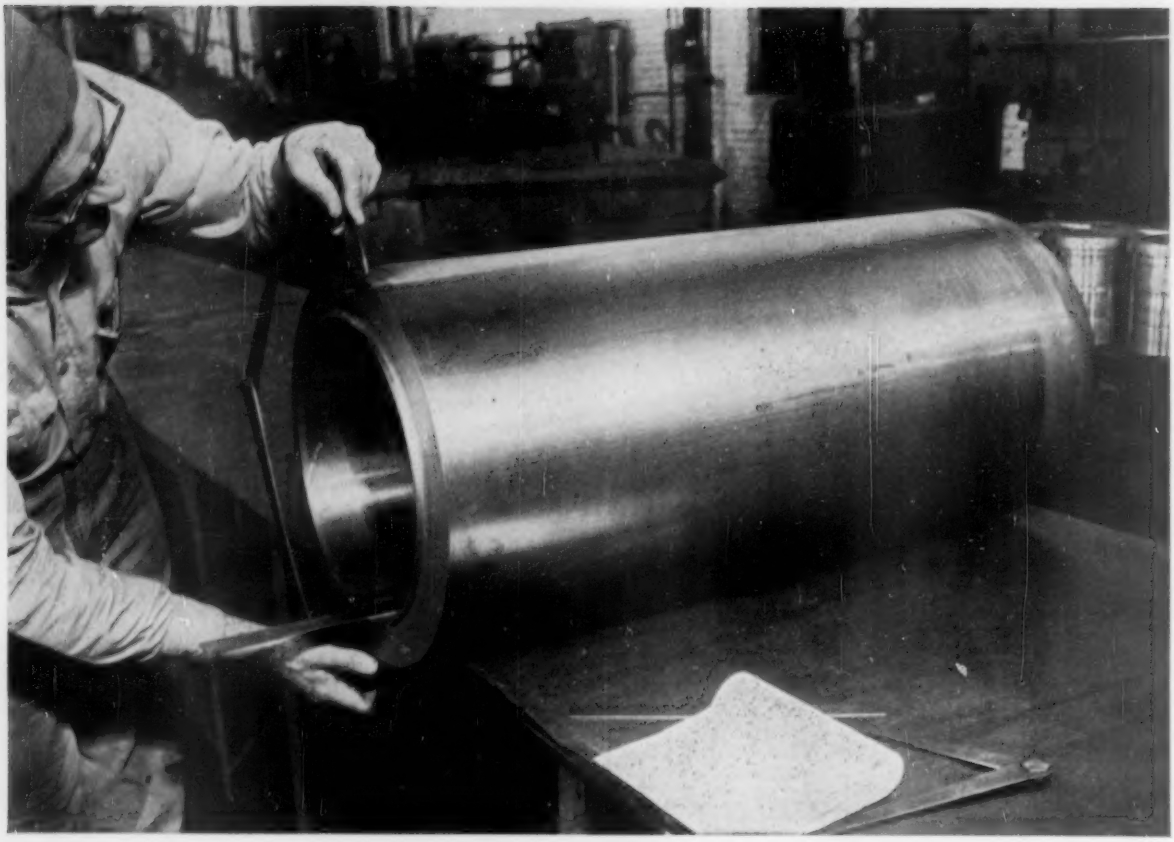
Disadvantages . . . Both of these methods have disadvantages. The reproducibility precision of the A.P.I. Gravity test is more than the change in gravity that can be tolerated. Hence, normal deviations of testing using this test can result in serious product contamination. Abnormal deviations, however, result from the conditions under which the test is determined in the field.

Because it is a specification control test for distillate burning oils (and is referred to in local, state and I.C.C. regulations), the Tag C.T. Flash Point test is pertinent as a reference test for contamination. The apparatus is readily available in routine laboratories and is reliable for the detection of contamination.

However, the precision attained on contaminated samples with this test is not as good as that obtained with normal samples. For reasons of safety, the tester can only be used in locations approved for open flames. And, relatively, the method of test is time-consuming. During the time required for obtaining results by this method, large quantities of product could become contaminated.

A faster, safe, and accurate method is necessary. The Contamination Index method satisfies this need. In a matter of seconds, the operator can determine if the distillate burning oils meet flash specifications. Contamination index is measured by a combustible-gas indicator. This instrument quantitatively detects the explosibility of the vapors. The Contamination Index method measures the vapors evolved from the samples when tested under specified conditions. Correlations between the explosive nature of the vapors evolved and the Tag C.T. Flash under the conditions described have been developed. The method employed will be outlined in the next installment.

*Product control department and †Sales operations division, domestic marketing department, Atlantic Refining Co., Philadelphia.



The Bethlehem shops produce major parts for rotary rock bits. This spindle forging is a good example.

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Whenever you need forgings, it's economically sound to make Bethlehem your chief source of supply. Our prices and deliveries are fully competitive, and nobody beats us on quality.

The photograph above shows one of the many types of oil-country forgings we supply regularly. It is a shell used in equipment that separates water and hydrocarbons from natural gas. Made by Bethlehem's pierce-forging process, this particular piece is 4 ft long, has an ID of 12 in., and weighs in the neighborhood of 900 lb.

Cylindrical forgings of this type can be handled by Bethlehem in weights from 25 to 5,000 lb, with ODs ranging from 4 to 28 in. and IDs from 1⅞ to 16½ in. Lengths of almost 6 ft can be produced by our draw-bench equipment.

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BETHLEHEM STEEL

BETHLEHEM STEEL

by W. L. Nelson
Technical Editor

Vapor Load of Vacuum Towers

In vacuum towers in which the usual overhead product is condensed in the tower rather than letting it go overhead as a vapor, how do you compute the amount of vapor handled by the trays?—R.F.G.

In towers such as the one shown in Fig. 1, scarcely any internal reflux is handled by the tower. More specifically, scarcely any reflux vapor travels up the tower through the plates but a large amount of liquid reflux travels across the plates and down the tower. Thus, the tower need not be designed for the conventional large amounts of reflux duty, even though large amounts of liquid reflux are introduced and withdrawn (with gas-oil product) from the tower. The downcomers must, however, be large enough to handle the large reflux.

In the simplified tower system shown in Fig. 1, no vapor travels to the top of the tower except the "tail" of low-boiling material in the feed, any gas-like products of the heating, air that has leaked into the system, and any process steam that is used. The gas-oil product itself is almost totally condensed on tray No. 3 although a small amount of its lowest-boiling components may escape to tray No. 4 (and even No. 5) before being condensed. Likewise, a small amount of the lowest-boiling part of the liquid reflux stream may be vaporized on tray No. 3 and caught on tray No. 4 (or No. 5) to be returned to tray No. 3 and the gas-oil drawplate.

Thus, the vapor load of the tower consists only of the gas-oil product and the small recycling of light components occurring between trays Nos. 3 and 4. In the "cleanup" section only the gas-oil product is handled plus, of course, the small washback needed to deliver entrained material to the bottom of the tower.

For practical purposes, the tower handles only gas-oil vapor.

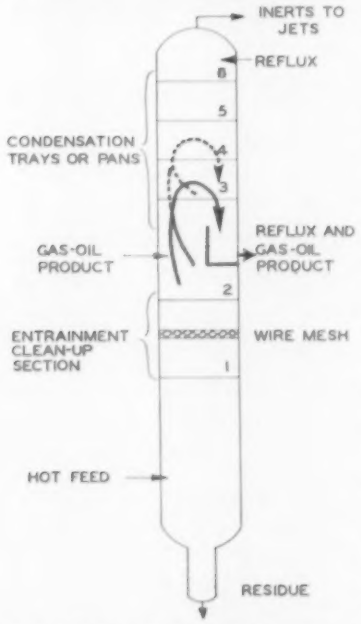

Fig. 1—Simplified diagram of a vacuum flash tower for producing catalytic feed stocks.

Fifty Per Cent Relationships Between Flash Vaporization And Other Curves

In your answer of March 16, 1953, regarding the relationship between all common vaporization curves, you fail to mention the relationship between the 50 per cent temperatures of A.S.T.M. curves and the 50 per cent temperatures of flash vaporization curves. Where can we obtain such a relationship?—G. Wm. K.M.

Relationships are shown by nearly all of the investigators listed in the answer of March 16, 1953, including page 393 of the third edition of Petroleum Refinery Engineering (McGraw-Hill Book Co., Inc., 1949) but most of these are not entirely satisfactory. A somewhat better relationship is shown in Fig. 1 and it is especially useful in connection with the comprehensive Questions on Technology of March 16, 1953, because it is entirely consistent with all of the other data published therein. In other words you can start with either the true-boiling-point curve or the A.S.T.M. curve of a material, and essentially the same flash curve will be found for either type of distillation curve.

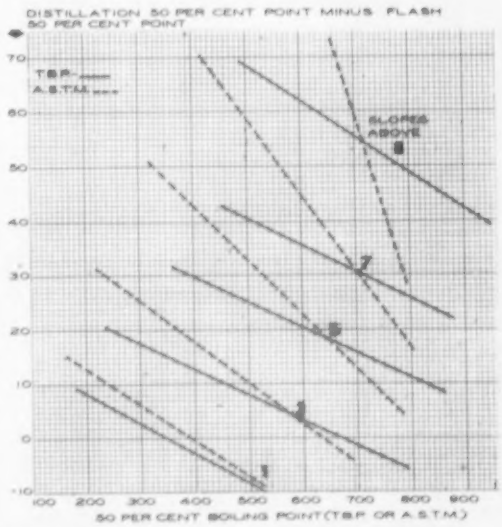

FIG. 1—Relationship between distillation temperatures at 50 per cent vaporized and the flash (E.F.V.) temperature at 50 per cent.

Intensity of Refinery Illumination

How much lighting is common in refineries?—M.S.W.

The following foot-candles of illumination are considered adequate. Aging and dust accumulation soon decreases the intensity of illumination and hence extra foot-candles should be provided:

Drafting rooms	50
Laboratories—fine work	50
Offices	40
Machine shops—fine work	30-40
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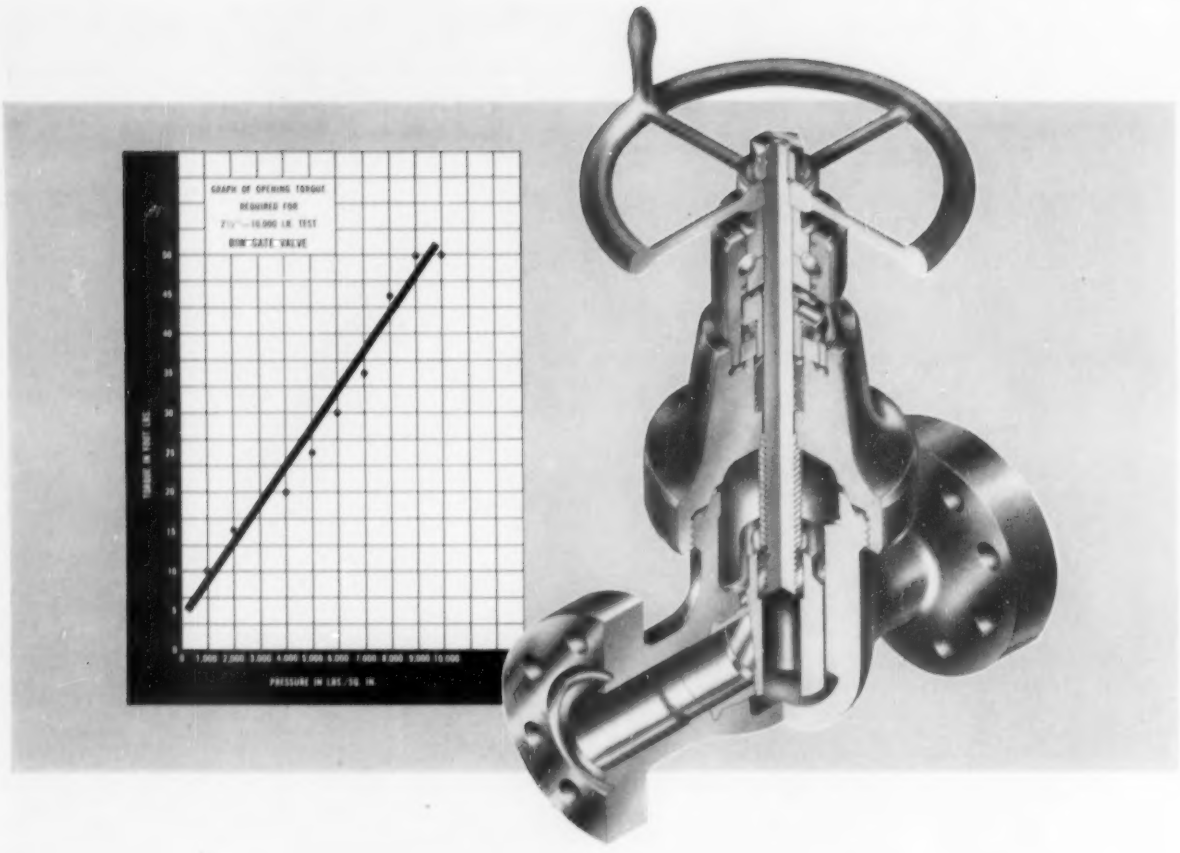
Laboratories—rough work	20-30
Machine shops—rough work	20
Compressor rooms	10-15
Electrical switch rooms	10-15
Pump rooms	10-15
Reception rooms	10-15
Wash rooms	10-15
Gages	10
Locker rooms	10
Operating—platforms	10
Receiving and shipping	10
Storage rooms	5-10
Furnaces	5
Rear of control boards	5
Warehouses	5
Passageways	3-5
Yard areas	½-1



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Shell Oil Co.'s Unit U-34 Rig made 2,272 ft. of hold during a single 8-hour shift during the week of April 18, 239 ft. deeper than the previous record set by this rig in March. The new record set by the rig is only 33 ft. short of the U. S. record.

Rig 24 set the new Canadian drilling record at the Shell D-3-12 Midale well in southeastern Saskatchewan. Sam Holstein supervised the rig. The driller was Frank Leggott. Crew members are: A. Schott, W. H. Harlos, and H. O. Matthies.

Crow Drilling & Producing Co., Shreveport, is joint operator with J. R. Brown, and contractor on a projected 9,000-ft. wildcat test to be drilled in northern Harrison County, one of Mississippi's three coastal counties. Location, on government land in 30-4s-10w, is 6 miles east of Howison. It is a Lower Cretaceous test.

Banner Drilling Co. is drilling for Aztec Oil & Gas Co. at 1-A Ute, a Tocito wildcat test in 15-31n-15w, 8 miles southwest of Ute Dome, in San Juan County, southeastern New Mexico.

Penrod Drilling Co., Shreveport, will drill the 1 W. L. Moody, Jr., for Hunt Oil Co. in Jackson County, Texas, 19 miles southeast of the town of Vanderbilt, Tex. The 10,500-ft. wildcat is being drilled as a tight hole on the John Duncan Survey, Abstract 103.

W. P. Taylor has contract for a wildcat in Assumption Parish, South Louisiana at F. A. Callery, Inc. 1 F. L. Daigle et al. Unit in 32-12s-13e, Napoleonville area. The well will go down to 12,000 ft.

The Offshore Co. has contract for a 11,500-ft. wildcat in Lafourche Parish, South Louisiana. They will drill the 4 Godchaux Sugars, Inc., for Southern Production Co., Inc., in 37-15s-18e.

H. L. Edwards has contract for a wildcat in St. Charles Parish, South Louisiana, for Arkansas Fuel Oil Corp. The 2 State Lease 2828 is in 14s-22e, and is the second wildcat in Lake Cataouatche. The well is projected to the lower Miocene sands. Edwards, who is located in Houston, will also drill a wildcat for Continental Oil Co. on the north flank of Bayou Long field, St. Martin Parish, South Louisiana. The 2-A Williams, Inc., will go to 12,800 ft. Location is just across the parish line in Iberia in 3-13s-11e.

Orlan N. (Red) Wilson has resigned as store manager for the Bethlehem Supply Co. in El Dorado, Kans., and will enter the drilling business under the name of Red Drilling Co. His offices at present are at 229 North Washington Street in El Dorado, Kans. He purchased a rotary drilling rig with

P. T. Mize (left), tool pusher, and one of his crews, on a rig Sam E. Wood, Alvin, Tex., contractor, is running for Stanolind Oil & Gas Co. on a workover job in Hastings field, north of Alvin, in Brazoria County, Texas Gulf Coast. Crewmen, left to right, are: C. J. Mize, driller; B. M. Hinton, derrickman; and Roy Gideon, and James Elkins, floormen.

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complete outfit of equipment and is ready to begin drilling operations. He expects to operate mostly in Kansas and northern Oklahoma. Some of his work will probably be done in Butler County, Kansas. His new rig is capable of drilling to 4,500 ft. or below.

Gardner Well Service has contract for the Lawrence H. Hoover 1 Bruni Estate, a wildcat in Barrocito Pasutre, Jose Vasquez Borrego Gr. and Blas Maria Gr., 17 miles southwest of Mirando City in Zapata County, far Southwest Texas.

Don Johnston is contractor for Fred Korf's 1 Gowen test in C NE SW 24-3n-47w, Yuma County, eastern Colorado. The well is in the area 13 miles northeast of the town of Yuma.

DM&R Drilling Co., Enid, Okla., has contract for the first five wells of a drilling program planned by LeCune Oil Corp. of Jefferson and Marshall, Tex., in a multiple sand area of Grant County, Oklahoma, 20 miles northeast of the city of Enid. This area is productive in five sands from 4,800 ft. to 6,300 ft. in the lower Wilcox sands.

Contract has been awarded to **Howard Parker** for Colorado Oil & Gas Corp. and Anderson & Cooke 1 Keuhn et al., a new 7,000-ft. Harris County, Gulf Coast Texas wildcat, 4 miles south of Tomball townsite. The well is located in the William Perkins Survey, Abstract 621. It is ⅔ mile south of the Tomball Dome. Materials are moving in for immediate start.

Glasscock-Wilson Drilling Co. has contract for Gulf Interstate Engineering Co.'s 12,250-ft. wildcat in Cameron Parish, South Louisiana. This Grand Chenier area test is to be put down 2 miles north of Hog Bayou field production. The 1 Mermentau Mineral Land Co. is in 5-15s-6w.

D. E. Vasser has contract for Natural Gas & Oil Corp.'s 12,500-ft. test in King's Ridge area, Lafourche Parish, South Louisiana. The well is the 2 Lafourche Parish School Board, an east offset try to new production. Location is in 16-19s-23e.

Bullard Drilling Co. of Houston is contractor for a new wildcat south of South Crowley field, Acadia Parish, South Louisiana. The well is Warren Petroleum Corp. 1 Sarver heirs et al., 35-19s-1e, 1 mile south of production. The wildcat is on the Ebenezer Prospect. **Bush Drilling Co.** has contract for a 9,000-ft. wildcat on the southeast flank of Bayou Mallet field, Acadia Parish. The Otis D. Coston 1 Clement Richard is in 13-7s-1e.

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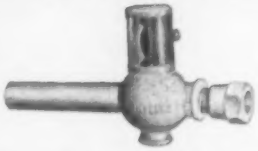

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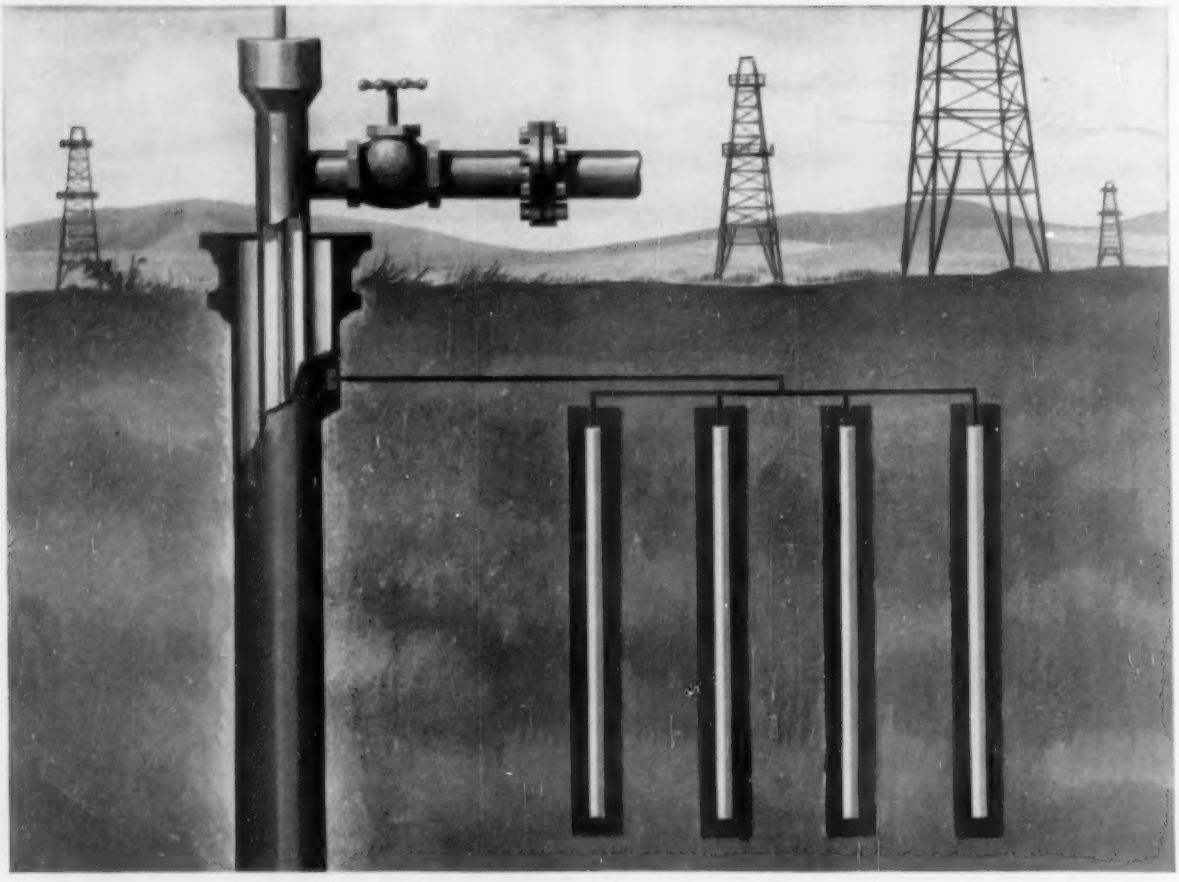

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WHEN the inset Combustible Gas Indicator reads from 0.1 to 0.5, workers entering the tank need masks . . .

. . . But the air ejector at left, combined with the sprayer above, can quickly drop this reading to below 0.1.

How to make tank cleaning a safer job

by Jack E. McGuire

WITHOUT a doubt, there are few if any other pipeline safety problems having a more varied nature than tank cleaning. The tank which in winter can be cleaned without too many safety problems becomes, in the middle of summer, a piece of dynamite with a short fuse. The tank storing high-gravity crude is much more dangerous than a tank which, for example, has contained fuel oil. Small 500-bbl. field tanks or 250,000-bbl. tanks all definitely have their problems.

Author is division foreman, Standard Oil Co. of California. Paper presented before San Joaquin Valley safety conference of Western Oil and Gas Association, Bakersfield, Calif., 1955.

For years, tanks have been cleaned and repaired. Have there been accidents? Yes! One involved a 1,500-bbl., three-ring, bolted steel tank which had been drained prior to cleaning. The bottom drain emptied into a drain pipe about 170 ft. long extending well outside the fire wall, and from there via an open ditch to a sump.

A welder working near the end of this drain pipe wanted to cool a piece of metal and dropped it into a pool of water in the ditch. An immediate explosion took place in the drain pipe followed by two more explosions in the tank. The results were five frightened employes and a semispheroid bolted tank.

Another explosion involved a 1,600-

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bbl. two-ring bolted tank. The tank had been cleaned and the repair work, including welding inside the tank, was supposedly completed. The blinds had been removed from the vapor system when a welding job outside the tank was found to be unfinished. One arc, and two men working on the roof were hurled by the explosion to their graves. Evidently the vapor line gate did not hold.

I'm sure these accidents bring to mind others of a similar nature. Oil tanks must be cleaned, regardless of the hazards, so how do we do it the safe way?

The first step as in any other oilfield job is the main one, that of safe job planning. Here the safety program is made or broken. Poor job planning can make a simple job turn into a serious or deadly accident. The careful supervisor sees to it that all personnel know exactly how the job is to be done, what hazards can arise, and how they can be handled. No item should be considered too small to mention.

Basic Safety Practices

While each tank has to be considered independently, certain minimum requirements should be used for a bench-mark in planning. In our company, these basic standards are contained in a small book entitled "Safe Practice Regulations," a copy of which is given to every employe.

These minimum requirements, I believe, should be gone through briefly:

1. A qualified supervisor with experience is of the utmost importance, but only if he stays with the safety requirements of the job. For example, a good nose is a poor substitute for a combustible-gas indicator.

2. Remove all of the product in the tank, and flush and drain any internal suction, filling, or miscellaneous lines.

3. Disconnect, plug, or positively blind off all lines from the tanks, including suction, filling, steam, foam, and vapor lines. Make sure they stay disconnected or blinded until the job is completed.

4. Ventilation and testing of the tank interior is the backbone of the safety program. This is without a doubt the most serious time for all concerned. When man-hole covers are to be removed, make certain that the gases escaping will not find a source of ignition. Petroleum vapors have been known to travel up to a mile on still days before igniting. Being heavier than air, the gases can form a blanket of death near the ground which, when ignited, will kill all in its path.

The most common tool for testing

USE positive line blinds where lines are left connected. Don't depend on the valve alone. Then tag the gate so it won't be opened.

the tank interior is the combustible-gas indicator, or commonly called the "smeller." On the West Coast, probably the one most frequently used is the J. W. Combustible Gas Indicator having a scale reading from 0.0 to 1.0 in graduations of one-tenths. Using this instrument, our department has adopted the following rules:

(a) 0.5 to 1.0—No men are allowed in the tank; no hosing from the manholes. Let's face it—no work if it includes men doing work inside the tank.

(b) 0.1 to 0.5—Tank is safe for hosing from the manholes. Tank is safe for men to clean or hose from inside the tank if they are properly equipped. (and, I might add, wearing fresh-air masks). All the foregoing are permitted if an indicator is in constant use.

(c) Below 0.1—Men may enter without hose masks and the tank is safe for any operation including hot work. Conditions must be such that there would be no increase in this reading in any part of the tank at any time.

Ventilating with ejectors . . . One extremely good method of aerating a tank is with the use of air ejectors. But aeration is sometimes a long process. What else can we do? Where enough water is available, mechanical washers installed through a manhole can do about 90 per cent of the cleaning job without any more manpower than is necessary to hook up the sprinkler-type washer.

We have successfully used this type cleaner in tanks up to 150,000-bbl. capacity. It does not do a 100 per cent job, but normally it will leave only the small quantity of mud and scale which can easily be cleaned up by hand.

An interesting test tank-cleaning job was done at our Kettleman pump station.

This particular tank was a nominal

55,000-bbl. floating-roof tank. After the pumpout, it contained 20 to 30 in. of oil-impregnated wax which is characteristic of storing Kettleman Hills waxy crude. When agitated, it gives off large volumes of combustible gases.

The roof, on high legs, was about 5½ ft. above tank bottom. At the center manhole, a 4-in. gas exhauster was installed. This exhauster has a ratio of about 30 to 1. Thus, using 270 cu. ft. per minute of air into the exhauster, the total ejection of air and gas from the tank approximated 8,000 cu. ft. per minute.

To continually test the air in the tank, a small air siphon was installed through the gas indicator. Pulling about 2 in. of water vacuum, we had a continuous analysis from within the tank. The manholes in the roof were removed and the shoes of the roof blocked out from the shell.

Washer aids aerating . . . We then installed a mechanical washer, or agitator, through a manhole. This washer was a rebuilt agricultural-type sprinkler with the head changed so that we had two streams 180° opposed plus the main nozzle. Adding a mechanical ratchet and gear gave a vertical motion as well as radial in our two auxiliary nozzles. In such a manner, we were able to blast directly every portion of the tank bottom.

To start the test, we sampled the tank and the reading was over 1.0. We then started the air ejector only. In 30 minutes, the reading was 0.2 and it remained constant until we started the mechanical washer. When the washer was started the reading immediately rose to 0.5. In 4 hours, the reading had dropped to 0.2. In 8 hours, the reading was 0.1 and remained there for the balance of the cleaning. In 20 hours, the cleaning was completed and, with the ejector and washer shut down, the entire tank showed less than 0.1 on the indicator.

We used about 400 bbl. per hour at 180 psi. This amount of water is a little hard to obtain in some outlying tank farms, but with adequate sumps the water can be reused from a separation basin.

When sufficient water is unavailable, a good ejector can get the reading inside the tank to below 0.5. Under these conditions, fresh-air masks enable the crews to clean, but nevertheless the crew must be constantly alert for readings over 0.5.

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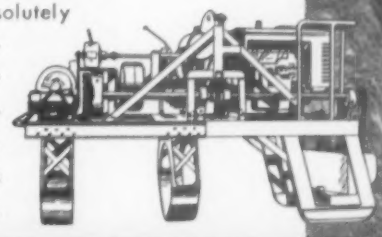

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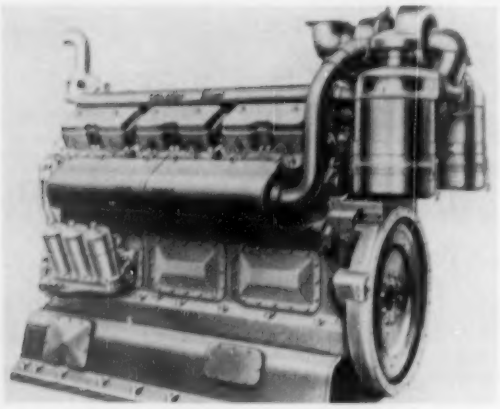

Heavy-Duty V-Type Engines Introduced

Two new heavy-duty V-type industrial engines are capable of producing up to 650 hp. (maximum). Available in turbocharged, roots-blown, naturally aspirated, and spark-ignited versions, the new 8 and 12-cylinder D375 and D397 (illustrated) are of four-cycle design.

New turbochargers for these engines enable them to produce increased power with less fuel by using the energy of exhaust gases which would otherwise be wasted. Improved engine-breathing ability, the result of a new cylinder-head design, makes it possible for the new units to take full advantage of the extra air made available by supercharging.

New exhaust manifolds are offered in dry, shielded, and wet versions to enable users to adapt the engines to specific needs. The new shielded manifolds utilize heavy layers of fiber glass, encased in steel, to keep heat out of the engine room without adding to the cooling load of the engine.

The new D397 and D375 spark-ignited engines produce 400 and 267 hp. respectively, using natural gas. Outstanding features are a 10-to-1 compression ratio, a low-tension magneto ignition system and new pistons. **For more information write or call: Caterpillar Tractor Co., Peoria, Ill.**

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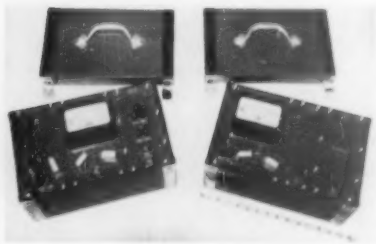

Portable Resistivity System Locates Structures

A new resistivity system provides a fast and economical means of prospecting for mineral deposits and geological structures. The resistivity method is useful in the location of sulfide ores, water, geologic faults, and other anomalies characterized by abrupt changes in electrical resistance.

The resistivity system consists of two separate instruments, the signal generator bank and the voltmeter bank. Although mechanically similar, each having three panels mounted in identical watertight aluminum cases, the two function quite differently.

The determination of ground resistivity requires the measurement of a length, a current, and potential. Four electrodes are placed in the ground at equal intervals in a straight line. The signal-generator bank provides a 10-cycle square-wave voltage which is applied to the two outer (current) electrodes. The voltmeter bank is a potential measuring device and is connected to the two inner (potential)

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electrodes. Observation of current and potential enable the resistivity for a particular electrode separation to be calculated. **For more information write or call: Houston Technical Laboratories, 2424 Branard Street, Houston 6, Tex.**

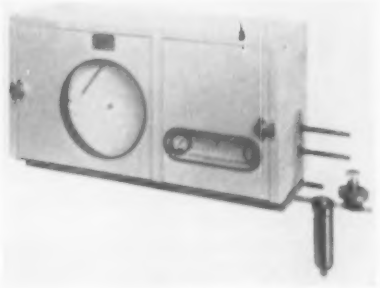
●

Coreco Provides Cathodic Protection to Casing

This well-casing d.c. generator is used in providing cathodic protection to oil and gas-well casing where rectifiers cannot be used because of lack of a.c. electric power.

The installation consists of a generator, control box, and ammeter which mounts on the pump housing. The generator runs off the pumping unit. Only one graphite anode is required, and the installation can be operated over a long period of time with little maintenance. **For more information write or call: Corrosion Rectifying Co., 1506 Zora Street, Houston, Tex.**

●



Liquid Gravitometer Made For Three Operations

The liquid gravitometer Model RPT is available in the following versions: Model RPT is for recording and the pneumatic transmission of specific gravity records. Model RPT-P is for recording specific gravity and pressure and for the pneumatic transmission of specific-gravity records. Model RPT-T records specific gravity and temperature and transmits specific gravity records. All models are complete with pneumatic recording receiver. **For more information write or call: Arcco Instrument Co., 3113 East Eleventh Street, Los Angeles 23, Calif.**

●

Weed-Control Chemical Kills All Vegetation

An industrial weed-control chemical called Nalco H-174 is a dry, granular material. The product kills all vegetation and is recommended for use wherever weeds, brush, or grasses create a fire or safety hazard or give plant property an unsightly, unkempt appearance.

Shipped and used dry, the Nalco H-174 is applied at a dosage of 300 to 400 lb. per acre. Because of the small volume needed, storage and handling problems are minimized. Ordinary fertilizer spreaders or seed sowers are used for application. The dry, granular form is reported as being virtually dustless, greatly reducing the possibility of chemical drift that endangers desirable vegetation near areas being treated. **For more information write or call: National Aluminate Corp., 6242 West Sixty-sixth Place, Chicago 38, Ill.**

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COMPETITION makes it necessary to squeeze the most out of the best. Competition makes squeeze cementing better, too. On your next job, call the company that is putting on the squeeze and keeping it there.

Engineered answers to oil well cementing

BJ SERVICE, INC.

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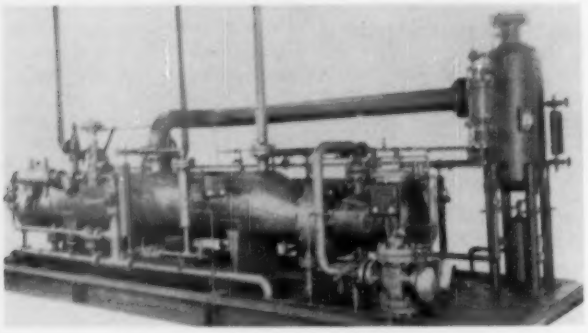


Gas-Chilling Unit Packaged for Field

Packaged gas-chilling units are available for field installation to supplement expansion cooling of gases for low-temperature separator units, resulting in increased liquid hydrocarbon recovery. Units are skid-mounted and include propane-refrigerant compressor, air-cooled refrigerant condenser and necessary heat-transfer equipment. Chillers can also be used at a field gas-compressor station discharge for additional condensate recovery. They require only fuel gas for operation. **For more information write or call: Graff Engineering Corp., 413 Meadows Building, Dallas 6, Tex.**

●

Hydraulic Pumping Unit Designed for Slow Pumping

A new hydraulic pumping unit is designed especially for slow pumping of heavy oil. The specifications of the new Model M10 are: cylinder bores, 4½ in.; maximum stroke, 120 in.; total piston area, 31.8 sq. in.; total piston displacement, 16.5 gal.; maximum operating pressure, 750 psi.; maximum polished-rod load, 24,000 lb. Maximum upstroke velocities are: with 56-g.p.m. power unit, 10-ft. stroke in 17.6 seconds; with 45-g.p.m. power unit, 10-ft. stroke 22.0 seconds; with 35-g.p.m. power unit, 10-ft. stroke in 28.7 seconds.

The upstroke velocity of this new model is set by the delivery of the power pump. Downstroke is made according to the rate of fall of the sucker rods through the heavy crude. The long, slow upstroke permits bottom-hole-pump operation at high volumetric efficiency.

The new model consists of a twin-cylinder assembly and compact power unit which includes a positive-displacement power pump and storage tank. The cylinder assembly mounts on a pedestal which is unitized with the power unit, so that the equipment can be moved away from the well head as a unit with the cylinder assembly in place, for well servicing when required. **For more information write or call: S. C. Carter Co., 1900 Santa Fe Avenue, Los Angeles 21, Calif.**

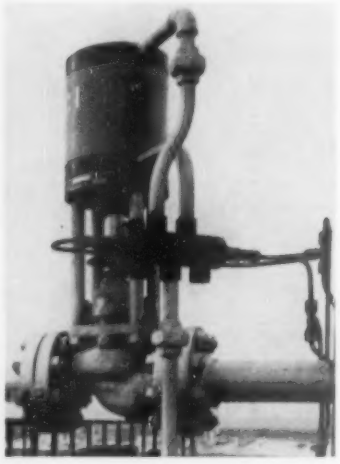
●

Piston Valves Operated By Double-Acting Air Cylinder

The Klingermatic air-operated piston valve is sealed by two resilient packing rings closely compressed around a finely ground and lapped piston. Only the top valve ring is in contact with the piston when the valve is in the open position. In the smaller sizes, the piston is solid and the top valve ring obviates the need for gland packing. In the larger sizes, the piston is hollow and balanced in order to reduce the effort required for opening and closing, in which case a gland packing is provided.

This type of valve construction readily lends itself to pneumatic operation by a double-acting air cylinder since no force is required to hold the valve closed or open, and the power is only required to move the piston from one position to another.

Motivation is achieved by mounting a double-acting air cylinder on columns fixed to the top flange of the valve body. The valve piston is connected to the piston rod of the air cylinder by means of a straight spindle. The piston



rod and the spindle are made of stainless steel. Tapped air connections are provided on the air cylinder.

Standard range of valves can be provided with pneumatic operation, from ½ to 6-in. bore, in screwed or flanged construction with bodies of bronze, forged steel, cast carbon steel, and cast stainless steel; with internal trim as required. **For more information write or call: Richard Klinger, Ltd., Klingerit Works, Sidcup, Kent, England.**

●

Machine Cuts and Bevels Small-Diameter Pipe

This portable flame-cutting and pipe-beveling machine is for small-diameter pipe 1½ to 4 in. The new Model O is completely portable and weighs only 7½ lb. The machine can be operated easily and efficiently by unskilled operators.

Employing the split-gear horseshoe principle, the new model allows its operator to place the machine on continuous pieces of pipe. A quick-operat-

F.L.A. added to the fracturing medium in this treatment helps solve fluid loss problems.

KEEPS FLUID LOSS UNDER CONTROL

F.L.A.* (Fluid Loss Additive) is a petroleum derivative in the form of a free-flowing black powder which is designed to lower the fluid loss of fracturing fluids.

When added to an oil well fracturing medium such as crude oil, gelled crude, refined oil, or an acid-oil or water-oil emulsion, F.L.A. substantially lowers the fluid loss characteristics of the medium. During a fracturing treatment, F.L.A. acts to lay down a film on the face of the formation and the natural fractures. This reduces fluid loss into the formation and makes possible longer fractures and deeper penetration of sand. F.L.A. can be added to either the sand or the fluid.

Clean-up is fast, too. F.L.A. is completely soluble in medium and low gravity crudes and only slightly less soluble in high gravity distillates and kerosene.

Let Dowell engineers help you solve your fluid loss problems. The treatment they recommend will be tailored to meet the characteristics of your well.

For more information, or service, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write to Dowell Incorporated, Tulsa 1, Okla., Dept. E-11.

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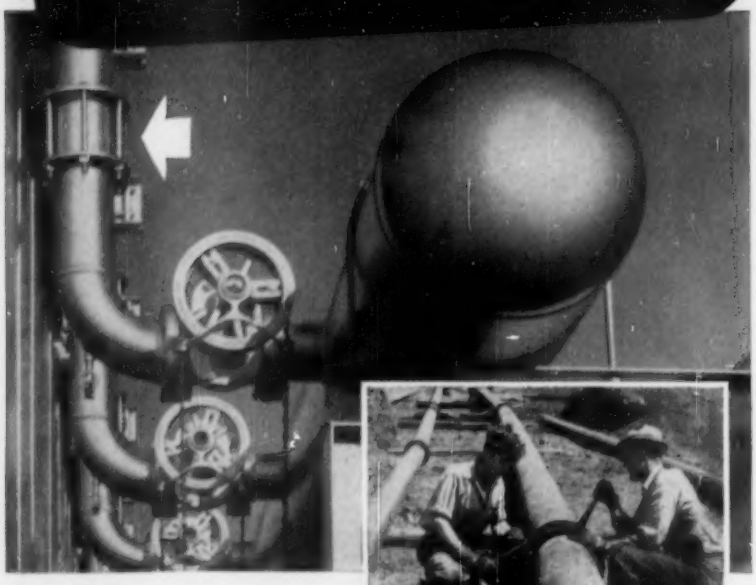
around a cooling tower... the DRESSER way is easier...surer!



ABOVE—Dresser Style 38 Couplings on 15 cooling tower lines for jacket water cooling. RIGHT—Workmen install Style 38 Couplings on field gathering lines.

Anywhere you're joining pipe, the handiest, surest way to get bottle-tight joints is with Dresser Couplings or Long Sleeves.

Dresser Couplings provide the "give and take" necessary to absorb vibration, settlement and other stresses. Specially compounded rubber gaskets permit up to 4° deflection at joints—yet with Dresser Couplings, these joints stay permanently tight.

The only tool you need is a wrench—no pipe threading is necessary. Any workman can install Dresser Couplings, averaging only two man-minutes per bolt.

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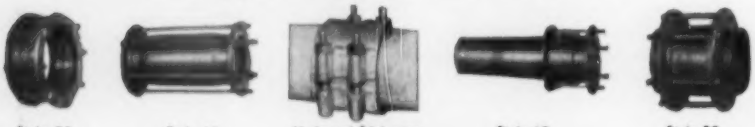

Style 38 Coupling | Style 40 Long Sleeve | Hydrepair* Asbestos Cement Pipe Clamp | Style 63 Expansion Joint | Style 39 Insulating Coupling

*HYDREPAIR is a trade-mark of Dresser Manufacturing Division

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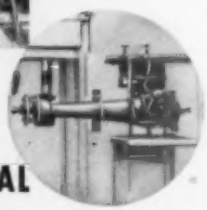
VERTICAL



OR HORIZONTAL

many more hours on stream without forced shutdown with NATIONAL AIROIL

OIL-GAS TANDEM COMBUSTION UNITS

Exclusively for vertical firing, the new National Airoil VERTICAL Tandem Block Units retain all the features of our regular horizontal Tandem Units . . . **plus:** special, precast refractory shapes for easier, cost-saving vertical installation and maintenance; secondary air inlet louvres for positive control of vertical flame pattern; and, all steel duplex detaching gear which enables swift, simple vertical burner changeover.

VERTICAL and HORIZONTAL Tandem Units hold air in the combustion zone until fuel and heated air are thoroughly mixed. This means that ignition takes place in a hot zone; the result: high fuel economy through more rapid combustion with a minimum of excess air. NATIONAL AIROIL's patented Tandem Combustion Units allow secondary air to be easily and accurately controlled. By adjusting air control louvres, flame can be shaped to radiate heat uniformly without tube impingement.

The VERTICAL or HORIZONTAL Tandem Unit is always fired with NATIONAL AIROIL Combination Oil and Gas Burners . . . has a high turndown ratio with a steady flame temperature using either fuel oil or gas. With the TANDEM UNIT's clean flame, a cold furnace can be brought to full capacity in a short time.

"Many, many more hours on stream, without shutdown" . . . yes, YOU will realize higher profits from YOUR heaters when NATIONAL AIROIL VERTICAL or HORIZONTAL Tandem Units are specified. Our new Bulletin 498 is yours for the asking.

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Southwestern Division
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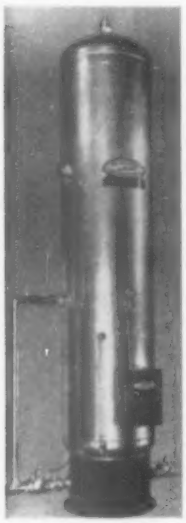
INDUSTRIAL OIL BURNERS, GAS BURNERS, AND FURNACE EQUIPMENT

ing boomer strap speeds up the process of changing the machine from one piece of pipe to another.

Changing the unit is a matter of replacing precision-made adapters which are properly identified for the various pipe sizes. The change from the smallest to the largest pipe size can be made in a matter of seconds. Any plain-barrel cutting torch may be used with the unit. **For more information write or call: H & M Pipe Beveling Machine Co., 311 East Third Street, Tulsa, Okla.**

●

Metering Separator Is Cyclic Accumulator Type



A new type metering separator with accuracy ratings up to 99.9 per cent is a cyclic - accumulation-type, positive - displacement liquid-metering vessel. This type vessel meters liquid by cyclic accumulation, isolation, and discharge of equal volumes. Each cycle is a known unit volume of ¼ to 10 barrels. The number of cycles is registered on a mechanical counter or recorder. Type C metering separators are available in 125 and 300 psi. working pressures. They are available in sizes from 16 to 48 in. o.d. Respectively, their lengths range from 6 to 12 ft., seam to seam.

The unit separates the well fluid into oil and gas and meters each fluid. Free water can be separated and metered if desired. After metering, the oil, gas, and water can be discharged separately or combined. **For more information write or call: Oil Metering & Processing Equipment Corp., 4843 Yale Street, Houston 18, Tex.**

●

Hand Tool Cleans Frozen Zerk Grease Fittings

A new hand tool that frees stopped-up zerk-type fittings on tractors and oil-drilling rigs generates hydraulic pressures up to 1,000 psi. when the piston is tapped with a 5-lb. mechanic's hammer. Unless the bushing has been turned so as to completely block the opening, the tool will blow out all hardened grease, dirt, or other foreign matter.

In operation, the tip of the tool is inserted in a can of motor oil. The piston is pulled back to fill the inner barrel with oil. Ram-O is then held against the frozen fitting and the piston head given a sharp blow with the hammer. When the piston goes down, it indicates that the fitting and shaft are clear. **For more information write or call: Gaskins & Stockman, 2369 Mountain Avenue, La Crescenta, Calif.**

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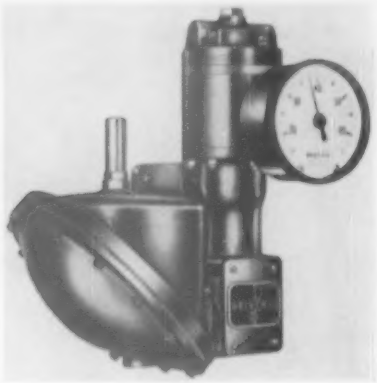

Pressure Transmitter Measures in Low Range

This absolute pressure transmitter is offered to handle pressure ranges from 0-5 to 0-760 mm. of Hg. It transmits a universal 3-15 psi. pneumatic signal and can be used with any standard pneumatic receiver or automatic controller. **For more information write or call: The Bristol Co., Waterbury 20, Conn.**

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- CATALOGS
- BROCHURES

Standard Meter Runs. This three-color, four-page Bulletin P-100 is for loose-leaf binding. It illustrates standard meter-run dimensions and keys the illustrations with tabular material. **For more information write or call: Maintenance Mechanical Corp., P. O. Box 2637, Houston 20, Tex.**

●

Emsco A.P.I. Pumping Units for heavy loads are completely described in a new eight-page bulletin, A-246, which covers the features, specifications, construction details and performance of Emsco 114, 160, 228, and 320 pumping units. Comprehensive visual treatment including large illustrations, cross sections, exploded views and photos of gears, gear train, subassemblies, and all essential parts of the pumping unit, make the bulletin easy to read and understand. **For more information write or call: Emsco Manufacturing Co., Box 2098, Los Angeles 54, Calif.**

●

Seamless Tubes and Their Many Uses is the subject of this two-color, 64-page bulletin. Booklet No. 2203 is put out by Mannesmann-Export G.M.B.H., one of the oldest manufacturers of seamless tubing in the world, and shows diagrams of how seamless tubes are made. It also presents photographs of seamless tubing in use in drilling, refining, and pipelines. **For more information write or call: American Mannex Corp., 233 Broadway, New York 7, N. Y.**

●

Gate-Valve Line Blinds are illustrated in Bulletin GV-17. These line blinds have no bolts to loosen and require no lifting of plates by the operator. They work on the gate-valve principle which makes their operation simple and easy. Two types are shown, the tee and ell types. Engineering data and specifications are given for both. **For more information write or call: Greenwood Valve Division, Vernon Tool Co., Ltd., 1101 Meridian Avenue, Alhambra, Calif.**

●

Mechanized Cleaning Gives You the Most for Your Cleaning Dollar. Mechanized cleaning methods are described in a new well-illustrated booklet. It describes solution-lifting steam guns, devices for cleaning tank interiors, portable spray units for cleaning in place, and other cleaning tools. Case histories, photographs, and installation drawings are shown. **For more information write or call: Oakite Products, Inc., 19 Rector Street, New York 6, N. Y.**

●

Let's Talk Tractors. More production from your tractor at lower cost is discussed in Form 31921. Such topics as how to multiply the work power of a tractor, how to prevent down time, and how to cut operating costs are taken up. A complete list of all attachments for Caterpillar tractors D6, D4, and D2 is given. **For more information write or call: Caterpillar Tractor Co., Peoria, Ill.**

●

Docks and Mobile Drilling Barges. This new 20-page, illustrated booklet describes De Long jacks and De Long technique of dock construction, of which the Texas Tower is an example. Other illustrated installations include drilling platforms, piers, and wharves. The De Long steel mobile drilling barges can be prefabricated anywhere. Then the dock-barge is towed to site. Units now are in service on several

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The important advantages of buying steel from Ryerson are that it doesn't matter *what* kind of steel you need, or *how much*, or *when* it's needed.
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Inherently Accurate!

- Eliminates Inaccurate "Spot Check" Counting!
  Continuous integration assures highest precision.
- Eliminates Cam and Linkage Errors!
  Unique design balances differential pressure signal directly against centrifugal force.
- Eliminates Calculations!
  Automatically extracts square root — shows totals in desired units.
- Eliminates Fire and Explosion Hazards!
  Simple, all-pneumatic operation requires no electric motors, wires, or contacts.

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Now you can integrate the flow of all process fluids or plant services *continuously* . . . with new accuracy . . . complete safety! The unique new, all-pneumatic Foxboro Flyball Integrator completely eliminates intermittent counting and fire hazard. Its simple, force-balance operation utilizes the 3-15 psi air signal from any differential-pressure flow transmitter. This signal is *continuously* balanced against the "flyball" force of the instrument's pneumatically-driven turbine. The square root function is automatically extracted . . . you read flow totals *directly*.

The Flyball Integrator mounts at the point of measurement or on a panel hundreds of feet away. Response and accuracy are completely unaffected by ambient temperature changes or pressure changes in turbine air supply. Ideal solution to all plant fluids accounting and in-process inventory checking. Write for complete details. The Foxboro Company, 605 Neponset Ave., Foxboro, Mass.

FIRST IN FLOW

drilling platforms in the Gulf of Mexico. **For more information write or call: De Long Corp., 29 Broadway, New York 6, N. Y.**

●

Temporary Seals for Oil and Gas Wells. A new four-page bulletin introduces Formjel, a temporary sealing or blocking material to aid in the control of acid and hydraulic fracturing treatments. The folder describes the purposes, operating uses, and application of the compound. Multicolor, schematic diagrams illustrate Formjel used to block an upper interval while the lower zone is being acidized; to block cement channeled behind casing; to seal packer leaks and vertical communication during treatment; and to block drainage channels during hydraulic fracturing. Also described are two companion agents, Thermogel, for high-temperature wells, and Firmjel, a permanent-type sealing agent. **For more information write or call: The Chemical Process Co., P. O. Box 831, Breckenridge, Tex.**

●

Wobbe Index Controller. Data sheet 342 explains the operation of the controller in applications where the air-gas mixture must be closely controlled. The Wobbe index is a function of calorific value and specific gravity. The Wobbe index controller enables automatic correction to be made for changes in either specific gravity or calorific values. **For more information write or call: George Kent, Ltd., Luton, Bedfordshire, England.**

●

The Universal Logger for mineral exploration is the feature of a new four-page, two-color brochure. Particularly adaptable for obtaining accurate electric logs of shallow holes, the instrument is simple to operate, portable, and rugged. The equipment obtains its power from the 6 or 12-volt electrical system of the transporting vehicle, and, weighing about 100 lb., will fit into any automobile luggage compartment. **For more information write or call: Surface Surveys, Inc., Phone EM 0229, 7415 Marquette Street, Dallas 25, Tex.**

●

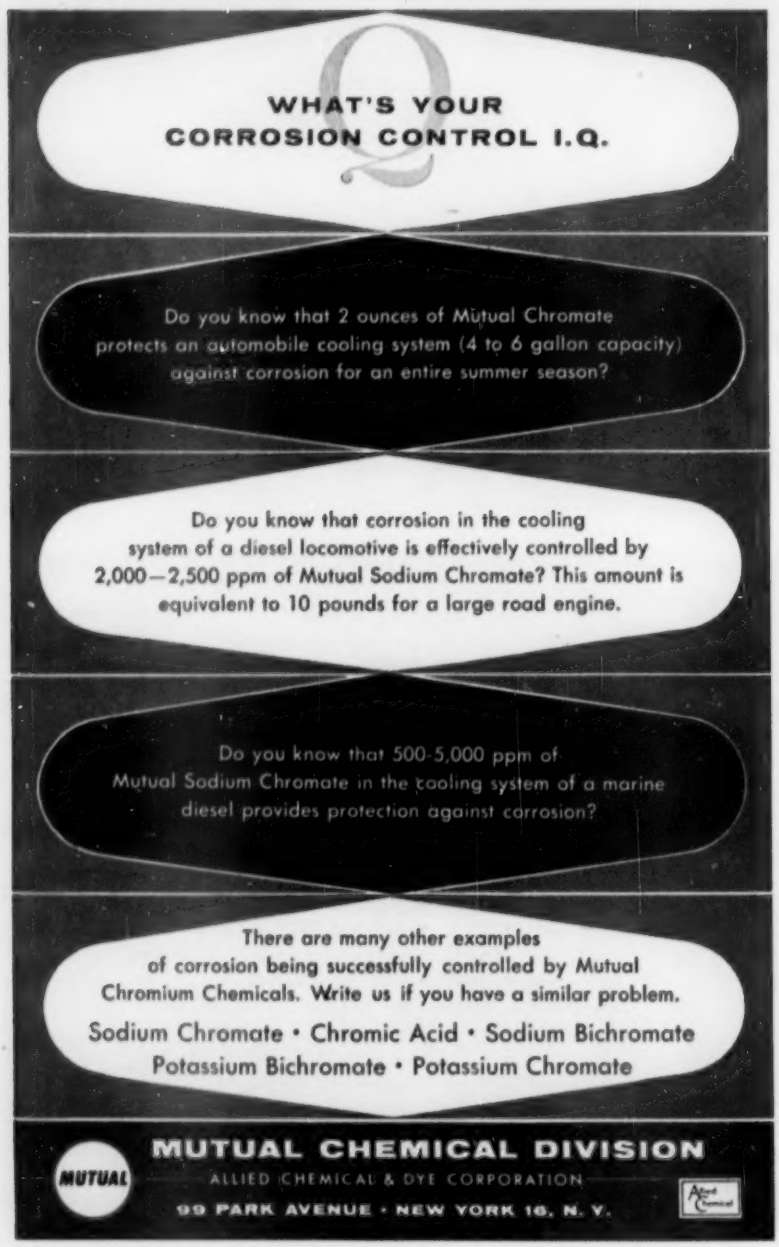
Cooper-Bessemer Compressor Catalog. A new engineering catalog, Bulletin F-80, describes the new Cooper-Bessemer Type FMP compressor. The FMP reciprocating compressor is built for field pick-up service, gas boosting, air drilling, and general industrial use. It is available with either single or twin frames and with single or multistage compressor cylinders. Ratings are up to 600 hp. as belt-driven or completely packaged unit. **For more information write or call: The Cooper-Bessemer Corp., Mount Vernon, Ohio.**

●

The G-R Twin G-Fin Section. An extended surface design of heat exchanger with longitudinally finned tubes is described in Bulletin 1401, just published. This unit was developed over 20 years ago for handling fluids of unequal heat-transfer rates and has proved widely successful. The new bulletin explains in detail the features of the design, outlines its various applications with illustrations of typical installations, quotes several field service reports, and includes complete specifications and dimensions. **For more information write or call: The Griscom-Russell Co., Massillon, Ohio.**

●

Rotarprest Ends for Pressure Vessels. Bulletin OG-881 gives a full range of sizes and complete engineering detail on dished and flanged ends for pressure vessels, spun on the Rotarpress. These ends combine semiellipsoidal form with large knuckle radius. The method effects a substantial reduction in plate thickness without loss of strength. **For more information write or call: G. A. Harvey & Co., Ltd., Woolwich Road, London, S.E. 7, England.**


WHAT'S YOUR
CORROSION CONTROL I.Q.
Do you know that 2 ounces of Mutual Chromate protects an automobile cooling system (4 to 6 gallon capacity) against corrosion for an entire summer season?
Do you know that corrosion in the cooling system of a diesel locomotive is effectively controlled by 2,000—2,500 ppm of Mutual Sodium Chromate? This amount is equivalent to 10 pounds for a large road engine.
Do you know that 500-5,000 ppm of Mutual Sodium Chromate in the cooling system of a marine diesel provides protection against corrosion?
There are many other examples of corrosion being successfully controlled by Mutual Chromium Chemicals. Write us if you have a similar problem.
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EQUIPMENT MEN . . . in the News

Continental Supply Names Four Store Managers

Continental Supply Co. has announced the appointment of four new store managers. Wade Farrar, Jr., will be store manager for the Dawson Creek, B. C., store while Robert R. Hall will fill that position at Continental's new store in Kimball, Neb.

Charles F. Battershell and Alexander M. Sellers will be store managers at Healdton, Okla., and Eunice, La.

Farrar was transferred from Healdton to his new post in Canada. He has been with Continental since 1948. Hall, previously a field salesman at Sterling, Colo., joined Continental 4 years ago. Battershell, an employe of Continental since 1947, was a field salesman prior to this appointment at Healdton. Sellers has been with Continental 4 years.

Jones & Laughlin Supply Opens Two New Stores

Construction has been completed on two new Jones & Laughlin Supply Division stores, according to Rainey Elliott, president of the firm headquartered in Tulsa. Shown on the left is the new store and warehouse at St. Elmo, Ill., and on the right is shown the new oil-field supply store at Big Spring, Tex.

The St. Elmo store, located adjacent to a Pennsylvania railroad spur, houses a business office, an Axelson pump-repair shop, and a warehouse. Store personnel include: Gerald Lee Berry, store manager; storemen G. H. Blair, C. J. Gibson, D. R. Gray, and B. J. Kelly; and C. W. Whitaker, sales representative. U. G. White, Jr., district sales manager, Illinois-Kentucky district, directs activities of the St. Elmo store.

The Big Spring store houses offices, warehouse, and an Axelson pump-repair shop. Lee B. Herndon is store manager. Other store personnel include C. V. Hester, B. D. Willbanks, and C. O. Wooldridge. The store is under the supervision of F. L. McFarland, district sales manager of the West Texas district.

Waukesha Sales Appoints Williams Ass't Sales Mgr.

The appointment of Frank Williams as assistant sales manager for Waukesha Sales & Service, Inc., distributor of oil-field engines, has been announced by Louis Pearce, president.

F. WILLIAMS

Waukesha Sales & Service has parts and service offices in Abilene, Corpus Christi, Dallas, Houston, Kilgore, Odessa, Pampa, Sherman, Snyder, and Wichita Falls, Tex.; Hobbs and San Juan, N. M.; Lake Charles, New Iberia, and Shreveport, La.

Collins Manages New National Supply Store

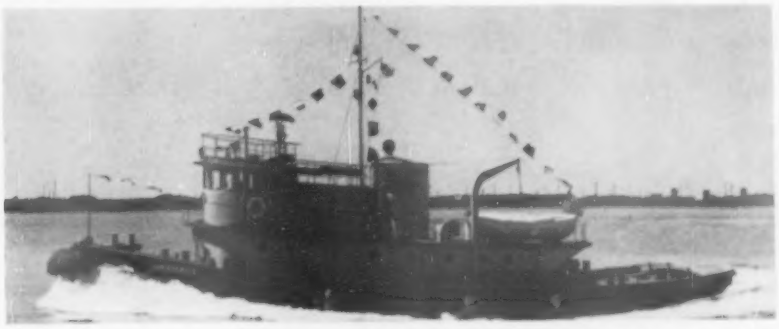
The National Supply Co. has opened an oil-field-supply store at Citronelle, Ala., with P. J. Collins as manager. The store is under the supervision of Ned Young, district manager of the Laurel district, in the company's Gulf Coast division.

Ideco Promotes Wilbur To Vice President

The promotion of Gordon G. Wilbur to vice president of Ideco Division, one of the Dresser Industries, has been announced by George W. Walton, executive vice president of Ideco. Wilbur who has held various positions in Ideco sales and technical-service departments, will now be in charge of export sales and have general administrative responsibilities.

G. G. WILBUR

Before joining Ideco in 1939, Wilbur worked as a crew member for a drilling contractor in Oklahoma. Prior to his promotion to vice president, he was assistant to the executive vice president at the Dallas headquarters.



Tug Boat Begins Offshore Oil Operation in the Gulf

A 1,700-hp. tug boat, designed for offshore oil operations in deep water, is ready for its assignment in the Gulf of Mexico. Commissioned April 14, the 105-ft. vessel can maneuver large portable drilling platforms to and from locations in the open sea.

Known as the Grampus, the tug was constructed by Gulfport Shipbuilding Corp., Port Arthur, Tex., for G & H Towing Co., Inc., Houston. Two other boats of similar design are on order for the same company.

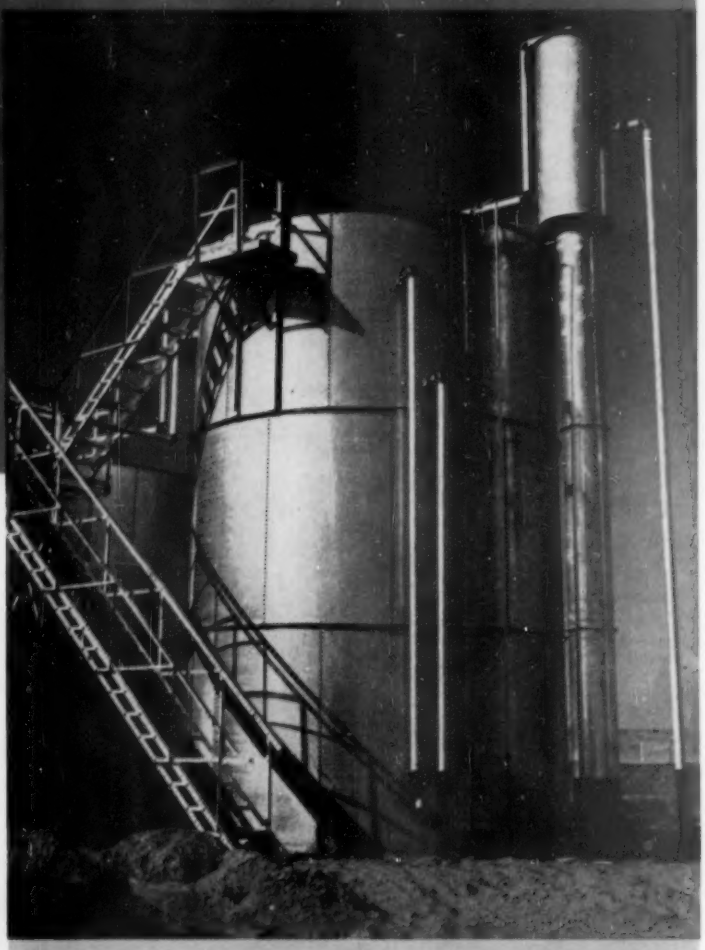
Although designed for open-sea towing, the tug is expected to be used largely for offshore operations in the gulf. One of its first assignments likely will be moving the portable platform, Mr. Gus, to drilling location over 60 miles from land.

FWD Makes Reed, Wagner District Sales Managers

Douglas E. Reed and Hunter O. Wagner, Sr., have been named new district sales managers for Four Wheel Drive Auto Co., it has been announced by G. F. DeCoursin, vice president, sales, of the Clintonville, Wis., heavy-duty truck manufacturing firm.

Reed, formerly vice president and general manager of Bulldog Transport Co., will be in charge of South Texas sales of four and six-wheel-drive trucks. Wagner's territory includes Arkansas,

Maloney-Crawford Bolted Steel Tanks for Versatile Uses



Maloney-Crawford's bolted steel tanks have many uses. To the left is one set up to handle the power oil for a subsurface hydraulic pumping installation. The tank in the background is a stock tank.

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TEXAS PANHANDLE REPRESENTATIVE: Atlas Tank Company—Pampa, Texas

Alabama, Louisiana, Mississippi, and western Tennessee, with emphasis on sale of FWD's new Blue Ox log skidder and its new line of ready-mix concrete trucks in addition to other FWD equipment.

Worthington Is Sales Mgr. For Charles Machine Works

WORTHINGTON

The appointment of Howard Worthington as sales manager for The Charles Machine Works, Perry, Okla., manufacturers of Ditch-Witch trenching machinery, has been announced by Edwin Malzahn, general manager. Worthington has been manager of the water-pump division of Reda Pump Co., Bartlesville, Okla., since 1950. Prior to that, he was employed by Flint Steel Co.

The Charles Machine Works has plans for a marketing-expansion program which includes the appointment of sales agents and franchised dealers to cover the market potential for light-duty trenching machinery throughout the United States and export markets.

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Homco Transfers and Promotes Personnel

Houston Oil Field Materials Co. has announced the following personnel changes:

I. G. Alley from Williston, N. D., to district manager of Canadian operations at Edmonton, Alta., Canada; Max Bassett from New Iberia, La., to Oklahoma City; Bryce J. Breeden from Sherman, Tex., to sales engineer in Oklahoma City.

M. C. Brock, field engineer to manager of survey division, Houston; A. F. Coleman from Houston to fishing-tool sales and services, Sherman, Tex.; Henry Crittenden from Houston to city salesman, Dallas; Clarence L. East from Odessa to Oklahoma City as director drilling engineer.

J. O. Redmon from Sherman to district manager in Oklahoma; Bernard Killiman from Houston to New Iberia; C. A. Dobson from New Iberia to Houston; W. W. Frazier, Jr. from Houston to Houma, La.; and T. H. Garrott from Harvey to Lake Charles, La.

Scarborough Is Security's Assistant Chief Engineer

Appointment of W. E. Scarborough as assistant chief engineer for Security Engineering Division has been announced by Carl Lichte, chief engineer for Security, one of the Dresser Industries. Lichte explained that Scarborough fills one of several new positions created by Security during the past year as a result of the firm's current expansion program.

Scarborough will direct Security's field-engineering services and will head engineering activities at the company's Whittier, Calif., plant. Prior to joining Security, Scarborough performed a variety of engineering assignments within the oil-tool industry. He has also had field-engineering experience in oil-producing areas of the United States, Canada, Mexico, and South America.

Dunn Heads Kellogg's New Western Regional Office

The M. W. Kellogg Co. has announced the establishment of a western regional office with headquarters in San Francisco's Russ Building. William R. Dunn, formerly Pacific Coast manager of Elliott Co., has been named sales manager of the new office, according to sales Vice President Russell J. Wolf.

The Kellogg company also announced that it has purchased a piece of property in the Houston Ship Channel area as a site for a contemplated

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Elmer Simmons
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plant for the production of new types of polyolefin plastics. Exact location of the land was not revealed. Kellogg's parent company, Pullman, Inc., recently announced that it had signed a license agreement with Phillips Petroleum Co. looking toward production of these plastic materials by a special process owned by Phillips.

According to Wolf, the new office will give Kellogg's western clients closer coordination with the company's East Coast facilities. Dunn has had a long association with oil and chemical industries on the West Coast.

Houston Purchasing Agents Tour Cameron Plant

Cameron Iron Works, Inc., was host to members of the Houston Purchasing Agents Association April 4 for a conducted plant tour. The tour included the melt shop with its 25-ton electric furnaces, ingot blooming and soaking furnaces. Visitors were shown the forge shop which contains the 11,000-ton split-die press built for Cameron by Baldwin - Lima - Hamilton Corp. This press is six stories tall and is capable of forging billets to 5,000 lb. It is one of the largest presses of its type in the world. Special heat - treat and quenching operations, complete tool and die production system, machining operations, and final assembly and testing of Cameron blow-out preventers, christmas trees, and other oil-well specialties were examined by the group.

Throughout the entire sequence of manufacturing operations inspections of every type were seen. Inspections start with a direct reading spectrometer report on steel samples. They continue through to the final assembled product. A product-testing laboratory contains a number of special testing facilities for unusually high pressures and a complete range of temperatures.

Herbert Allen, vice president and general manager, Cameron Iron Works, Inc., talks with Paul Berry of Republic Supply Co., president, Houston Purchasing Agents Association.

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Core Labs Makes Louisiana-Texas Personnel Changes

Core Laboratories, Inc., petroleum reservoir-engineering firm, has announced major personnel changes involving its Texas and Louisiana operations. R. J. Granberry will be manager of the South Louisiana area, and Frank O. Reudelhuber has been promoted to manager of Upper Texas Gulf Coast operations.

R. J. GRANBERRY

REUDELHUBER

Granberry, member of the board of directors and formerly district manager at Houston, will be headquartered in Lafayette, La. Reudelhuber, formerly manager of Core Labs' reservoir-fluids division in Dallas, will have headquarters in Houston.

Joy Manufacturing Appoints Drastrup Vice President

A. B. Drastrup has been appointed vice president of Joy Manufacturing Co., with headquarters at Joy's executive offices in Pittsburgh, Pa. Drastrup formerly was president of A. M. Byers Co.

Before being elected president of A. M. Byers Co. in 1954, Drastrup was an accountant with Indiana Steel Co. and later held a similar position with Columbia Steel Co.

Wright, Tipton Appointed Axelson Representatives

J. T. Wright and S. J. Tipton, Jr., have been appointed factory representatives for the petroleum-equipment department of Axelson Manufacturing Co., division of U. S. Industries, Inc., according to K. S. Ramey, sales manager of petroleum equipment division.

Wright will cover the Anson and Ballinger, Tex., area and Tipton, the El Dorado, McPherson, and Winfield, Kans., area.

Oil Well Names Store Manager, Representatives

Appointments of Luther C. Whalin and Vernon W. Brazelton as field representatives at Sundown and McCamey, Tex., and naming of Donald E. Kyle as district representative, production-equipment sales at Gainesville, Tex., have been announced by William Miskimins, Central Midwest area manager of U. S. Steel Corp.'s Oil Well Supply Division. The appointment of Charles O. Damron, Jr., as Pauls Valley, Okla., store manager and naming of Jack T. Cline as field representative at Lindsay, Okla., were announced by Mark Barkhurst, Mid-Continent area manager. The assignment of M. L. Childress as field representative at Carmi, Ill., was announced by C. H. Maynard, eastern-area manager.

Whalin has been located at Sundown since he joined Oilwell in 1949. Brazelton was employed by the division at McCamey in 1954. Kyle joined Oilwell in 1951, became field representative at Anson, Tex., in 1954, and was transferred to Gainesville in 1955.

Damron was employed by Oilwell in 1951 and has served the division at Oklahoma City, Seminole, Cushing, Pauls Valley, and Lindsay, Okla. Cline, who has been with Oilwell since 1951, has been located in Pauls Valley, Elk City, and Lindsay. Childress was with Oilwell at Mount Carmel, Ill., from 1952 until his transfer to Carmi in 1955.

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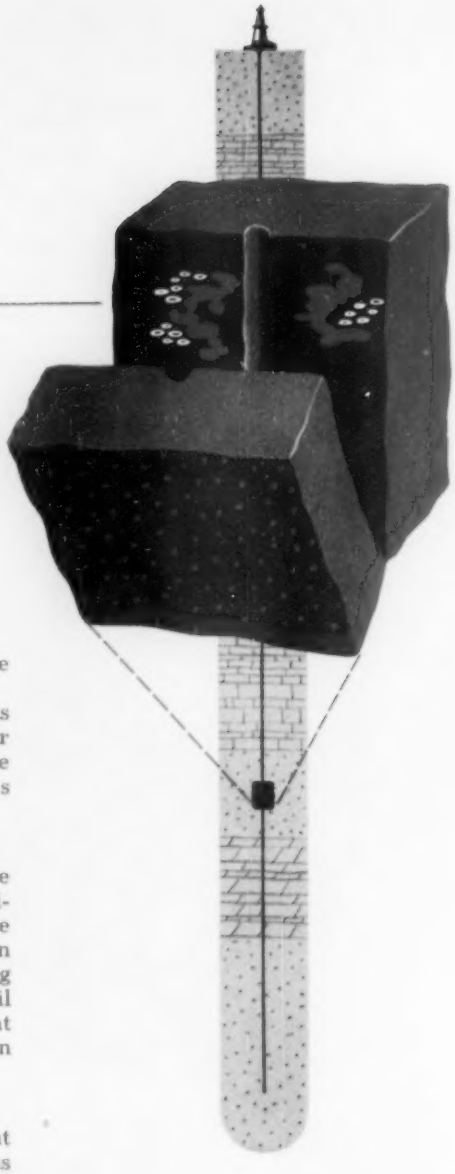

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Because Hyflo lowers interfacial tension, it can clean out water blocks as well as emulsions. And Hyflo is valuable as an emulsion-*preventer*. Used with most types of fracturing treatments, Hyflo makes it likelier that production will be boosted. It does so by minimizing the formation of emulsions between fracturing fluid and interstitial water. And, it removes interstitial water from the flow channels in the formation.

If production in your well is not up to its potential maximum, a trained, experienced field man from Halliburton will be glad to discuss the use of Hyflo or one of the many other production-stimulating measures at your disposal. Call your local or district office of the Halliburton Oil Well Cementing Company.

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F. J. Pettijohn: "The trend to indoor geology has gone too far . . . and

A Return to the Field . . . Is Most Necessary"

by Frank J. Gardner

GREAT changes have come to the oil-finding professions in the past decade. Perhaps no other field of study has seen so much advancement in techniques, skills, and theory in so little time.

But in the process, have the oil finders forgotten something? Has the emphasis that has been placed on research, laboratory work, and theory blinded them to that basic cornerstone of their science, the outcrop?

A blunt reminder . . . There are those who think so. And at the recent convention of the American Association of Petroleum Geologists in Chicago, geologists were bluntly reminded of the fact. In his address as president of the Society of Economic Paleontologists and Mineralogists, a division of the A.A.P.G., Francis J. Pettijohn, of Johns Hopkins University, cautioned them against straying too far from field and stream. He aptly titled his paper "In Defense of Outdoor Geology."

"The rise of the air-conditioned research laboratory, with its electronic equipment and white-frocked attendants, is visible proof of the thriving state of laboratory geology," Pettijohn observed, "but company research is in as much danger of losing touch with reality as is that of some universities. Nothing, my friends, is so sobering as an outcrop."

Of a dangerous attitude . . . The danger lies in an all-too-common attitude that field work is obsolete. In some schools, the president said, field training is tolerated only because it enables the student to grasp the "natural-history approach" of early-day geologists.

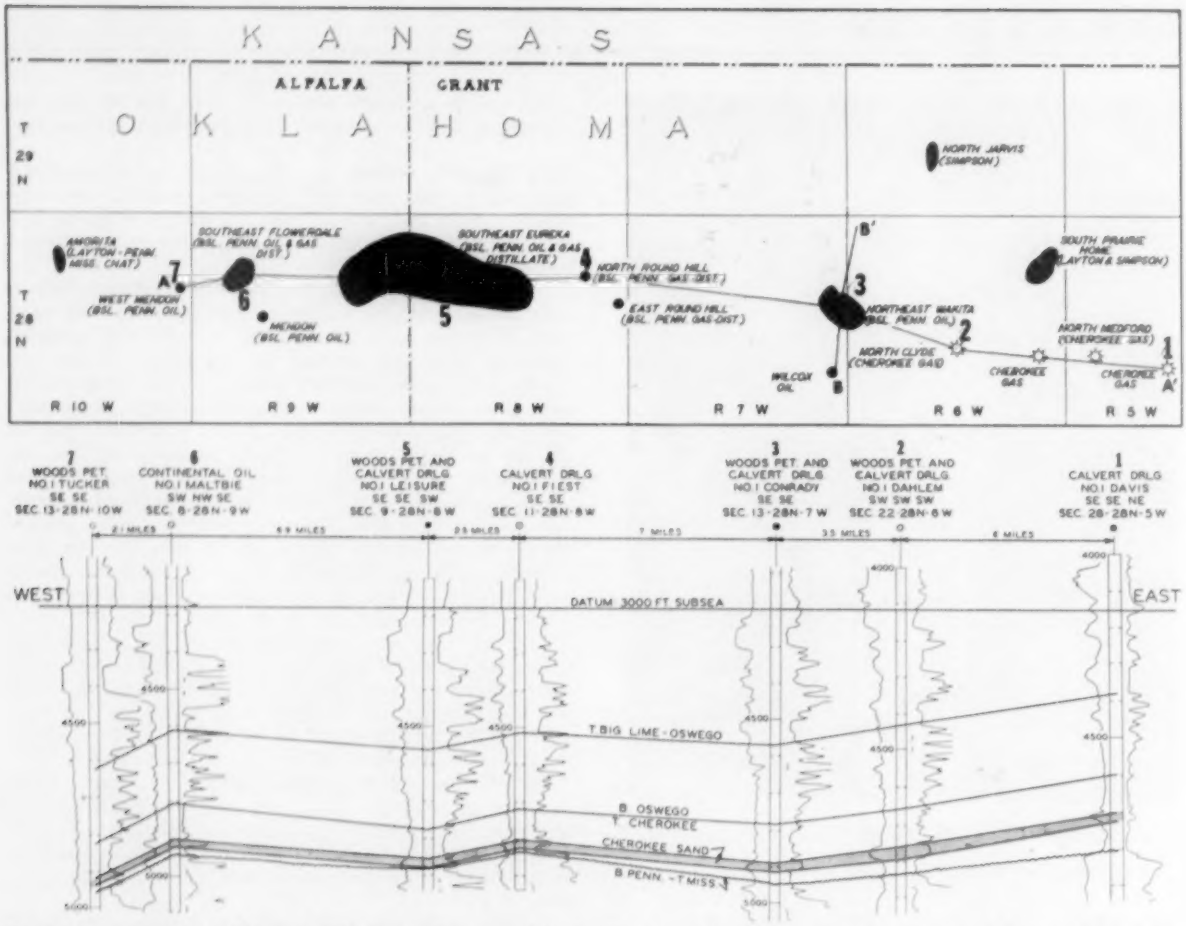
What has given rise to this situation? Pettijohn believes there are both tangible and intangible causes. For one thing, some geologists are afflicted with an inferiority complex, especially those who "consort with physicists and chemists —exponents of the so-called exact sciences." They bravely have their pictures taken in their laboratories, surrounded by spectrometers, miscroscopes, precision cameras, and the like, in an effort to impress upon company officials and visitors that theirs is as precise a science as others. "These efforts to emulate physics and chemistry would prove harmless enough," Pettijohn declared, "if the illusion created did not also deceive its creator. In the final analysis, most laboratory studies are but an extension of field observations . . . But to separate the laboratory studies from field work is ill-advised and may be disastrous."

To clinch his point, Pettijohn pointed to the four most significant ideas and advances in the study of sedimentary rocks during the past decade, and demonstrated that each one was a product of intensive field work. Each of these advances has brought about broad changes in the thinking of oil finders and their full impact still lies ahead:

- **The concept of turbidity currents** may prove to be the most revolutionary one in 50 years. It established the idea that the transport of coarse sediments to deep water is accomplished by turbidity underflows. It was disclosed by field study of graded beds of the Oligocene in the Apennines in 1950.
- **The study and understanding of paleocurrents** has resulted primarily from field study. Paleocurrents are the ancient currents which left their record in the vector or directional properties of the rocks. Observation of these properties can enable the geologist to determine the original source and direction of basin sediments. "Paleocurrent maps," Pettijohn predicted, "in conjunction with isopach and facies maps, will become the rule and not the exception."
- **The sedimentary framework concept** is primarily an extension of the facies concept into the third dimension, and has come essentially from field observations in places like the Mississippi Delta and the ancient Rio Grande. Both concepts were stimulated by the great interest in stratigraphic traps for oil.
- **The greatly expanded knowledge of reefs and related structures** came from concurrent studies of both modern and fossil reefs, in many cases by the same person. It is hardly necessary, of course, to point to the immense practical value of such field work to the science of finding oil.

Dr. Pettijohn has scored a telling point. He's not advocating the destruction, or even the reduction of laboratory work. "Most of the advances just reviewed," he says, "have been accompanied by first-class laboratory work—but the laboratory work was done in conjunction with field work, and in most cases was done by the same person who did the field work."

So if somewhere in your attic, there's a certain hammer, symbol of all rockhound activity, and a compass, the field man's badge of identification, take heed. Dust them off, get in your car, and get down to earth, oil finder.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ALFALFA
GRANT
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WILCOX OIL
NORTHEAST WAKITA (BSL. PENN. OIL)
NORTH CLYDE (CHEROKEE GAS)
CHEROKEE GAS
NORTH JARVIS (SIMPSON)
SOUTH PRAIRIE HOME (LAYTON & SIMPSON)
NORTH MEDFORD (CHEROKEE GAS)
CHEROKEE GAS
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6 CONTINENTAL OIL NO.1 MALTBIE SW NW SE SEC. 8-28N-9W
5 WOODS PET. AND CALVERT DRLG. NO.1 LEISURE SE SE SW SEC. 9-28N-8W
4 CALVERT DRLG. NO.1 FIEST SE SE SEC. 11-28N-8W
3 WOODS PET. AND CALVERT DRLG. NO.1 CONRADY SE SE SEC. 13-28N-7W
2 WOODS PET. AND CALVERT DRLG. NO.1 DAHLEM SW SW SW SEC. 22-28N-6W
1 CALVERT DRLG. NO.1 DAVIS SE SE NE SEC. 28-28N-5W
2 MILES
4.9 MILES
2.5 MILES
7 MILES
3.5 MILES
6 MILES
WEST
EAST
DATUM 3000 FT SUBSEA
T. BIG LIME - OSWEGO
B. OSWEGO
T. CHEROKEE
CHEROKEE SAND
B. PENN. - T. MISS.

Fig. 1—The reservoir at Oklahoma's "30-mile trend" is a sand in the Cherokee shale section that is easily traced along strike. (Cross-section A-A').

Cherokee Trend Stretches Out 30 Miles

. . . and forecasts are that 60 sq. miles will eventually produce

by Norman S. Morrisey
Drilling-Development Editor

SIX-MILE-STEP by six-mile-step Oklahoma's Cherokee trend has grown from an OWWO to a narrow strip 30 miles long and 1 mile wide. The play had a very commonplace beginning, but follows a pattern that is becoming routine in Oklahoma exploration circles.

The Texas Co. reworked an old dry hole, its 1 Young in 18-27n-5w, Grant County. Then Continental Oil Co. worked over an old duster that had been drilled to the Wilcox in 1954. The results were encouraging, to say the least—an initial potential of 417 bbl. of condensate and 32,500 M.c.f. of gas per day on August 5, 1955. In rapid succession Calvert Drilling Co. came up with three discoveries, all new fields, and by the end of the year the play extended from 28n-5w to 28n-10w, a distance of nearly 30 miles. Four of the eight discoveries were workovers, pay zones that were either overlooked or uneconomic when the wells were originally drilled.

What is the oil trap? . . . The answer depends to a large extent on the geologist. The determining factor is definitely stratigraphic rather than structural. Structure does play a role, but the production apparently is related to the low areas rather than to the high parts of the trend. One possibility is that the production is associated with an old shoreline. The oil trap formed in the reentrants or bays where conditions were favorable for sand deposition. Another theory is that the trend is an old river channel.

A third solution is that the trap at Eureka may be an old sand bar. In Oklahoma and Kansas, many of the Cherokee fields produce from sand bars, deposited by offshore currents. Probably the most familiar to Oklahoma geologists is Ceres pool in Noble County. Here the Red Fork sand in the Cherokee section produces in a narrow belt about 1,000 ft. wide and 11 miles long. At Ceres the sand has an average thickness of 25 ft. and an estimated recovery of 160 bbl. of oil per

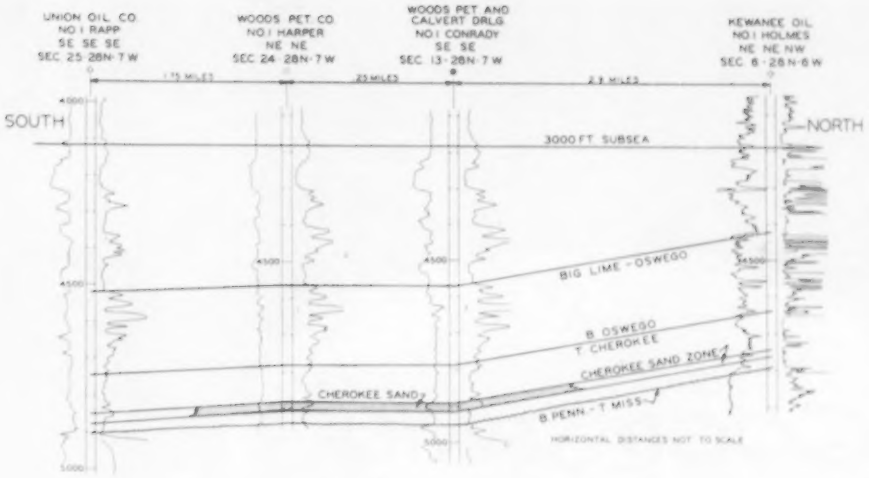

Fig. 2—The Cherokee sand pinches out both updip and downdip (cross-section B-B'). Subsurface data indicate that additional sand lenses may occur in the same stratigraphic position in the general area.

acre-foot of sand, or 4,000 bbl. of oil per acre. However, the sand at Eureka is not so well developed as at Ceres, averaging about 20 ft. (Table 1). At Ceres, the production is continuous over the entire length of the sand bar. Preliminary data indicate that there may be a series of related oil fields along the Cherokee trend rather than a continuous line of producing wells. Some operators feel that production will be continuous along the trend.

Experience with other Cherokee sand lenses has shown that the reservoir energy is usually gas in solution and that the recoverable reserves are on the order of 125-150 bbl. of oil per acre-foot of sand. **Preliminary estimates place the recoverable reserves in the Cherokee sand in Grant and Alfalfa counties at 125 bbl. per acre-foot of pay.** The Cherokee trend produces gas and the gas reserves are estimated to be 700 M.c.f. per acre-foot of pay. Drilling has been retarded because there is no pipeline outlet for the gas at the present time. Several gas purchasers are negotiating for the reserves which have been estimated to be on the order of 500 billion cubic feet.

Drilling . . . The Cherokee area presents few problems to the driller. The sand occurs at a drilling depth of about 4,900 ft. The usual practice is to set surface casing at 250 ft. and then drill to the coring point, just above the expected Cherokee sand. The pay zone is cored and analyzed.

"If you can smell it, you can sell it," geologists claim, and use this rule of thumb for determining if the Cherokee sand section will make a commercial well. A good oil odor in the cores is worth setting pipe on, they say, even though the drill-stem test is inconclusive. Invariably the wells are fractured prior to completion, usually through perforations. The average oil well will make 25-50 bbl. per day natural; after treatment, wells have made as much as 75 bbl. of oil per hour.

Gas wells come in natural for 500,000 to 1,000,000 cu. ft. per day. This is increased two to three times by treating the pay with 250-300 gal. of mud acid. Fracturing increases the natural flow rate 5-10 times.

Pay zone . . . The producing zone has been called Red Fork, basal Pennsylvanian, Bartlesville, and Cherokee sand. Actually the sand occurs in the Cherokee shale section between the base of the Oswego limestone and the top of the Mississippi limestone. Locally the producing sand is in direct contact with the Mississippian, hence the name basal Pennsylvanian sand. In other parts of the trend, however, there is some Cherokee shale between the base of the sand and the Mississippian. For this reason, many geologists prefer the term Cherokee sandstone. The strike section (Fig. 1) shows the relationship between the pay sand and the Mississippian limestone. Notice that on the dip section the sand pinches out both up and down dip (Fig. 2).

To date, no wells have encountered water and the Cherokee sand play is still in an early stage of development drilling. Optimistic forecasts indicate that as much as 60 sq. miles will eventually produce.

TABLE 1—TYPICAL RESERVOIR CHARACTERISTICS OF THE CHEROKEE SAND

Porosity, per cent	16.7
Permeability, md.	15.0
Estimated connate water, per cent	43
Initial reservoir pressure, psia.	2,000
Oil gravity, °A.P.I.	36-37
Estimated gas recoverable down to 100 per cent abandonment pressure, M.c.f./acre-ft.	700
Distillate recoverable at 10 bbl. per 1,000 M.c.f., bbl./acre-ft.	7.00
Estimated recoverable oil by primary means, bbl./acre-ft.	125
Average sand thickness, ft.	20

TABLE 2—DRILLING DATA, CHEROKEE TREND, GRANT AND ALFALFA COUNTIES, OKLAHOMA

Pay zone	Cherokee sand
Total depth (average), ft.	4,900
Normal rig time distribution (average):	
Days on footage rate	14
Days on day work rate	2
Total days (spud to rig release)	16
Cost data:	
Footage price (average)	$ 3.25
Day work rate with drill pipe (average)	650.00
Day work rate without drill pipe (average)	625.00
Bit data (average):	
Total number of bits	18
Feet per bit	275

Nearest supply center: Blackwell.
Usual fuel: Gas-butane.
Terrain and roads: Good.

Casing program (average):

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	250	200
Oil string	5½	4,900 (through the sand)	250

Mud summary:
Average mud cost: $2,000.00 per well.
Usual mud program: Salt water type mud used; mud up around 3,800 ft.; starch for water loss; cottonseed hulls for lost circulation; water loss 10-15 will clean up pay zone sufficiently.

Geological data (average):	Formation tops (ft.)
Big Lime-Oswego	4,533
Base of Oswego	4,570
Cherokee sand	4,751
Mississippian	4,873

"The pay zone is cored and analyzed. 'If you can smell it, you can sell it', geologists claim, and use this rule-of-thumb for determining if the Cherokee sand section will make a commercial well."

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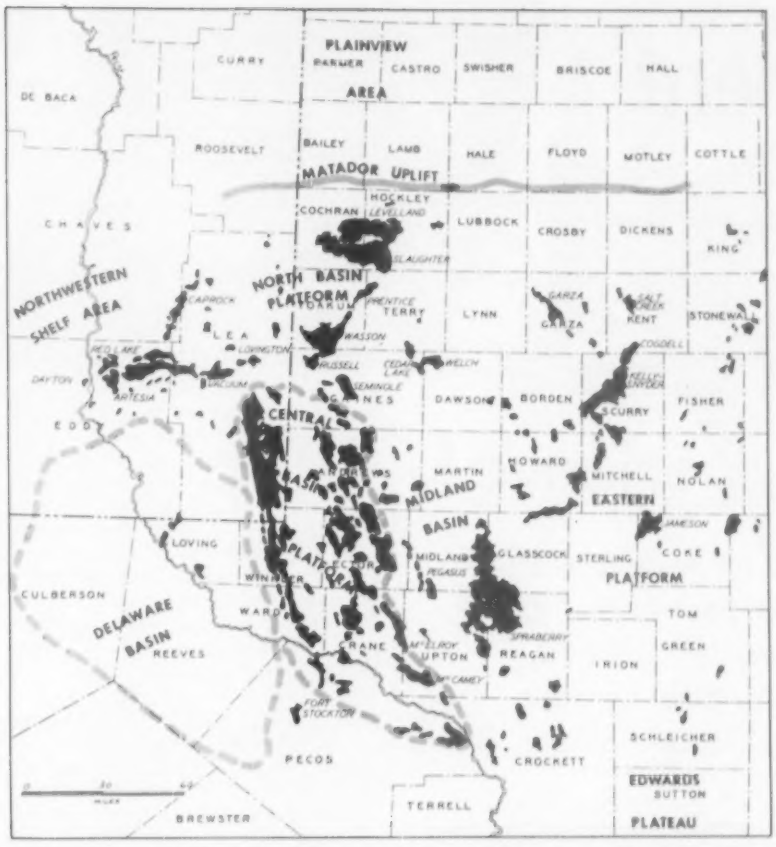

THE PERMIAN BASIN of West Texas and Southeast New Mexico contains more than 20 per cent of the entire nation's crude oil reserves. Drilling continues to increase throughout the region each year, and a bright future for this important petroliferous province is in store.

What's the Outlook for The Permian Basin?

by William E. Dougherty

THE Permian basin of West Texas and Southeast New Mexico continues, year after year, to be one of the most important oil provinces in our nation. Even under current proration schedules, total annual crude-oil production is of major significance. It is larger, actually, than the present annual production of any individual state except Texas. Present Permian basin crude-oil reserves total more than 20 per cent of the entire nation's reserves.

It is no wonder, then, that in this important area, competition among many hundreds of operators and companies is exceptionally keen.

Author is western division geologist, Humble Oil & Refining Co. This article appeared originally in the Midland (Tex.) Reporter-Telegram.

With minor fluctuations, the total number of wells drilled each year continues to increase, and wildcatting for new reserves follows that same trend. Geological exploration, particularly subsurface, and geophysical activity (primarily reflection seismograph), increased steadily over the past to a very high level which has been maintained throughout recent years. This, of course, is one of the major factors influencing the drilling of wells.

It should not be overlooked that the effectiveness of the seismograph is being stepped up continually, not only with improved but also with new techniques. In addition to better results in territory previously covered, new areas (formerly in the "too difficult" or "too expensive" categories) are being brought into the sphere of normal seismic exploration. The current high-level use of the modern seismic crew doubtless will point the way to many new fields and, consequently, to a continued high rate of drilling.

Great areas remain . . . It is interesting to note that by far the greatest amount of seismic effort is still spent in the most densely drilled portions of the Permian basin, from Gaines and Yoakum counties on the north, to Ward, Crane, and Upton counties on the south. This means, of course, that great areas remain to be worked in detail at some future time by this exploration tool.

Similarly, a large amount of geological energy spent in painstakingly detailed investigations is devoted to these same highly developed areas. However, other geologists are charged with the exploration responsibility of the remainder of the territory, and their work ranges from regional subsurface studies to both reconnaissance and detailed surface mapping. Many of these surface and subsurface geological investigations, aided in turn by gravity meter and magnetometer surveys, point the way for the future seismograph assignments.

There is an ever-increasing wealth of subsurface data available for study by the geologists and petroleum engineers in the Permian basin area. And the success of detailed analyses by these qualified experts is abundantly clear, not only in the discovery of new producing areas, but in the upward revisions in reserve estimates for old fields.

Reservoir management . . . Much of the future production in this area will, of course, come from newly discovered fields and new producing horizons in old fields. Of considerable importance, however, is the added amount of oil that will be produced because of the laudable trend toward more intelligent handling of the individual reservoirs. Properly handled pressure-maintenance and second-recovery projects should double the recovery from many fields.

New well stimulation and completion practices are due abundant praise in our modern oil-field operations. Oil shows that were weak, even by cable-tool standards a few years ago, now are regarded as significant—and completions from such zones are being made every day. Many marginal producers currently are being reworked into satisfactory and commercial producers by the use of modern techniques.

This is a country where it is extremely difficult, and also unwise, to write off any field as "finished" either when

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the wells appear to be depleted or when the productive limits of the field appear to have been defined.

Consider here such fields as Westbrook in Mitchell County, Harper in Ector County, Moore in Howard County, Means in Andrews County, Sand Hills and McElroy in Crane and Upton counties, and many shallow fields in southeastern Lea County, New Mexico. There is no doubt but that much of the new production and added drilling in many such areas is due primarily to new and better stimulation and completion practices, coupled with optimistic detailed analyses of available data. That these new methods will be even further improved, and other promising techniques discovered, is to be expected in our American way of life.

Such unsolved and perplexing problems as the Spraberry Trend, with its large reserve of presently unrecoverable oil, will not permit our inquiring scientists to relax for long. It would indeed be negative to assume that this is the end, rather than just another forward step in the technological march toward better oil-field practices.

Deeper drilling . . . Deeper drilling in old fields or on known structures will provide the Permian basin with much of its future oil and gas. But because of increased drilling and operating costs, this type of development probably will continue less rapidly than the shallower lateral extensions mentioned before. This deeper drilling will also follow even more comprehensive studies, including both geologic and detailed seismic data. Nevertheless, it is a most important part of the future of the territory.

In addition to searching for both shallow and deep oil in the well-established producing provinces of the Permian basin, operators have before them the invigorating challenge of frontier provinces, a number of which have been inadequately explored by the drill.

In summary, the search for future oil in the Permian basin could be expected to follow several broad lines of endeavor:

1. The rejuvenation of oil fields with new technique.
2. The step-by-step process of extending the limits of proven fields.
3. Exploring and drilling for new structures in well-established provinces.
4. Deeper drilling for new pays in old fields or structures.
5. Careful evaluation of subsurface data for the location and development of stratigraphic traps.
6. Wildcatting known oil areas by random drilling of relatively shallow to medium-depth new holes, or by entering old dry holes for the sole purpose of fracturing tight sand carbonate sec-

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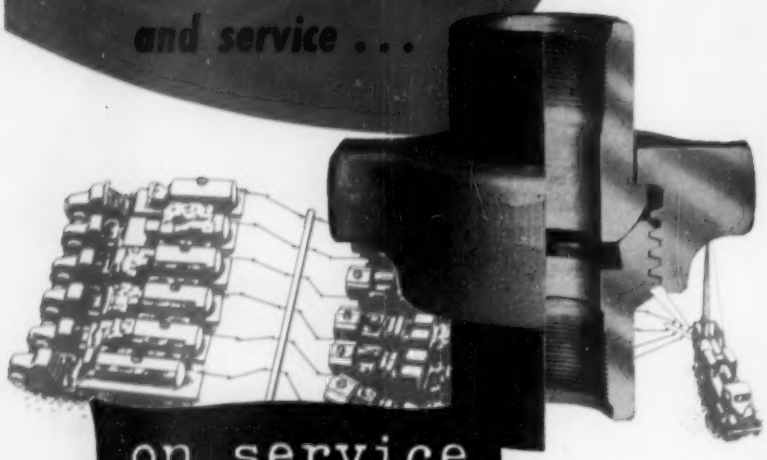

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tions which show oil stain or fluorescence.

7. Wildcatting for new fields in frontier provinces which appear geologically favorable, but which have little or no production or activity at present.

The growing trend toward specialization in oil industry work, and the conscientious efforts on the part of industry for better recoveries from the fields emphasize the following comments.

It is increasingly apparent that technical men in all phases of the oil industry must not only learn to work together more closely but also must achieve a better understanding of at least the basic principles of the other phases of the work.

Cooperative effort . . . Cooperative effort among the many operators in the industry, and among the mineral and royalty owners as well, will be increasingly necessary in the future as additional recovery of crude-oil reserves is sought through field-wide pressure-maintenance and secondary-recovery projects. With the obvious growing future need for additional oil and gas, there can be little excuse on anyone's part for not making every effort economically possible to extract all of the oil from a reservoir.

Accumulation of accurate and adequate reservoir data by operators early in the life of a new field makes possible the orderly planning of development and production. The existing reservoir energy can be utilized to best advantage, and means to augment it can be initiated. The maximum efficient rate of production can be established. The proper number of wells to drain the reservoir in a reasonable period of time can be planned. And the drilling of needless extra wells, with the resulting waste of goods and services, can be avoided.

A much greater percentage of the oil in place will be recovered as more oil operators find, develop, and produce their fields under sound practices. This in turn will mean increased reserves for the Permian basin and the bright future we anticipate.

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EXPLORATION HIGHLIGHTS

APPALACHIAN

EASTERN KENTUCKY

Kentucky West Virginia Gas Co. have completed their 6306 James Hall, located on Middle Creek in the Floyd County sector of Big Sandy gas field, as a dry hole. Test was taken to and through the Silurian Big Six sandstone and bottomed at 2,700 ft. Markers included: Maxon at 737 ft., Big Lime 916 ft., Berea 1,348 ft., Corniferous lime 2,014 ft., Big Six 2,642 ft. Big Six sand made only 21,000 cu. ft. of gas after shot and was plugged as noncommercial.

OHIO

A quarter-mile step-out to production at Hermanville resulted in a 60 bbl. producer after treatment. On 1 S. J. Irvin, Section 35, Canaan Township, Wayne County, the Clinton was found at 3,399-3,419 ft. with a fair showing natural.

● Preston Oil completed a 249-bbl. well at the north end of New Castle pool on 2 D. R. Hagans, Lot 24, New Castle Township, Coshocton County. Clinton was logged at 3,223-84 ft. with 10 bbl. natural.

● Oil Development 1 Emmett Shuey, Section 9, Hopewell Township, Licking County, ⅓ mile from production, gaged 80 bbl. after fracturing from Clinton at 3,149-80 ft.

WEST VIRGINIA

In Greenbank district, Pocahontas County, West Virginia, Columbian Carbon Co. 1223 U.S.A., rank wildcat, elevation 3,591 ft., was dry in the Oriskany sand topped at 5,607 ft., TD 5,796 ft. Salt water was encountered in this formation. This company's 1220 U.S.A., in this district remains shut down at 3,300 ft.

● Licking district, Tucker County, Hope Natural Gas Co. 9985 J. H. Ludwick, is at 1,351 ft. and 9993 Earl Fike is at 352 ft.

EASTERN INTERIOR

ILLINOIS

Coles County Rosiclare Area Develops Rapidly

A new producing area in Coles County is developing at a fast clip. The discovery well in the new area 6 miles northwest of Mattoon in Cooks Mills Consolidated pool, was Thomas C. Rappe 1 Macklin and Caton, SW SE NW 9-13n-7e.

This well was completed for 192 bbl. per day from the Rosiclare sand at 1,861-72 ft. The area has since been extended at Harry Adams 1 Delbert Andres in NW SE NW 16-13n-7e. This well flowed 240 bbl. per day at 1,841-46 ft. Partlow & Cochonour 1 Ben Kuhn, NE NW NW 16, flowed 231 bbl. per day.

GULF COAST

TEXAS GULF COAST

Oil Recovery Reported At Bee County Wildcat

Head-Welsh et al. reported recovery of 4,100 ft. of oil on test of the 1 J. Hynes, 3 miles northeast of Papalote, Bee County.

The drill-stem test was run at 5,585-90 ft. This new discovery prospect is located on the Timothy Hart Survey, Abstract 28.

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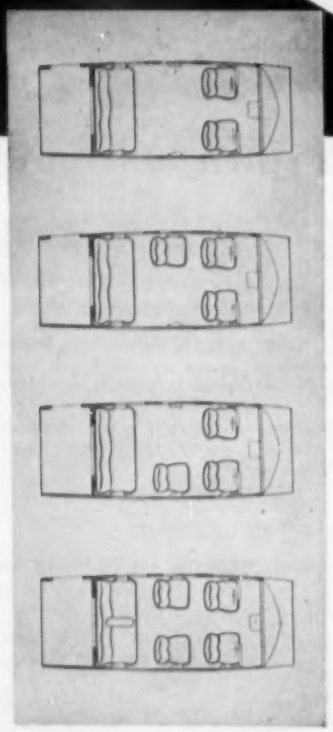

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OFFSHORE LOUISIANA

Two Wells Completed In Ship Shoal Area

Gulf Refining Co. completed two new oil wells off Terrebonne Parish in the Ship Shoal Block 154 area of the Gulf of Mexico.

The A-3 OCS 0419 flowed 177 bbl. of 30°-gravity oil per day on 9/64-in. choke from perforations at 5,194-5,212 ft. The C-3 OCS 0420 well made 192 bbl. of 31.5°-gravity oil per day from perforations at 7,218-40 ft.

South Pass Block 30 field . . . Shell Oil Co. completed the 3 State Lease 2675 well as the second producer in South Pass Block 30 field, off Plaquemines Parish in the Gulf of Mexico waters.

The well flowed 780 M.c.f. of dry gas per day on 1-hour potential test of perforations at 7,968-74 ft.

SOUTH LOUISIANA

New Gas-Distillate Area Opened at South Jennings

A new gas-distillate area was opened south of South Jennings field in Jefferson Davis Parish. The discovery well is Sun Oil Co. 1 Miller in 22-10s-3w.

The 14,000-ft. test flowed at the daily rate of 109 bbl. of 49.4°-gravity distillate plus 2,461 M.c.f. of gas per day from perforations at 12,356-66 ft. on 8/64-in. choke.

This new area is 1 mile south of South Jennings production. That area produces from 10,950 ft. in the Camerina zone. There are six pay zones

March exploration in Louisiana netted three new oil or gas fields. Offshore, Continental Oil Co. opened Grand Isle Block 47 oil field at A-1 State Lease 953. In St. Charles Parish The California Co. 1 Cities Service Production Co. in 39-12s-9e, was completed as a gas-condensate well, opening Kenner field. In Beuregard Parish, Sunray Mid-Continent Oil Co. 1 Lutcher & Moore Lumber Co. in 10-7s-12e, was completed as a gas well, opening Shoats Creek field.

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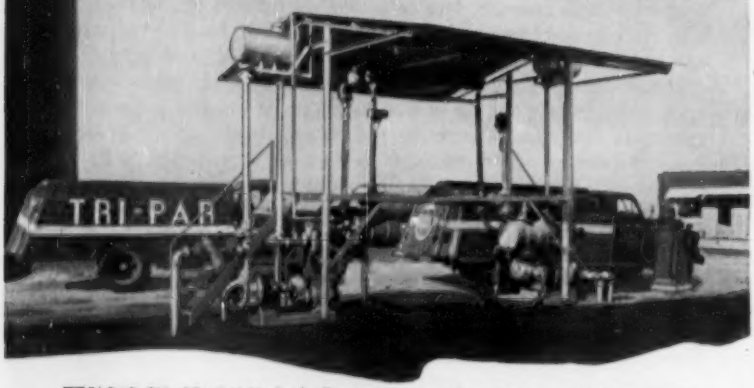

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in the field between 8,600 ft. and 10,940 ft. Both oil and gas are found in these zones.

New Map Published By State of Louisiana

A new oil and gas map of Louisiana has been published by the Department of Conservation and compiled by the Louisiana Geological Survey. This complete map shows all producing areas in the state as of February 1956. Oil and gas pipelines are shown, townships and ranges, parish lines, towns, and other geographical features. All offshore producing area are also shown on the map.

SOUTHWEST TEXAS

North Roman Field Opened in Jim Hogg

Jim Hogg County has a new oil-producing area at W. L. Cotton and Blair-Vreeland's 1 R. R. Yeager oil discovery. The well flowed 84 bbl. of 32°-gravity oil daily from perforations at 3,602-04½ ft. The discovery area is to be called North Roman field.

Gas Discovery Reported At Starr County Wildcat

A gas discovery was reported in Starr County last week at Appell Drilling Co.'s 1 M. Guerra & Son "A," 15 miles north of Roma. No details have been released as to the gage or perforations. Total depth, however, is 2,729 ft. Perforations were near the bottom of the hole. Location is in Share 77, Porcion 59.

WESTERN CANADA

ALBERTA

Oil Shows Reported at Simmonette River Wildcat

A Shell Oil Co. wildcat venture, 70 miles south-southeast of Grande Prairie and 80 miles northwest of Edson encountered a show of oil and gas during drill-stem test operations carried out in the Slave Point formation (Viking equivalent) recently. The show consisted of a gas flow at rate too small to measure and a pipe recovery of 15 ft. of clean light gravity crude oil.

Shell 9-9 Simmonette River, on LSD 9, 9-62-26w5, is being drilled by Shell on farmout acreage acquired under an exploration agreement with Central Ex-

plorers, Ltd., and Petrol Oil & Gas Co., Ltd.

The drill-stem test was run of the interval 7,011 to 7,026 ft. and it is understood that a further test 20 ft. below the previous test is currently being conducted.

Gas Discovery Recorded At Edson-Whitecourt

The team of Hudson's Bay Oil & Gas Co., Ltd., Canadian Fina Oil Co. and Stanolind Oil & Gas Co. has discovered natural gas in apparent commercial quantity at its current exploratory venture in the general Edson-Whitecourt area of central-west Alberta. A maximum daily flow rate of between 10.6 and 12.8 million cubic feet was recorded during drill-stem test conducted in the D1 zone of the Devonian formation.

The well, Hudson's Bay-Stanolind-Fina 1 Beaver Creek, is located on LSD 1, 32-56-19w5. It lies 130 miles west and slightly north of Edmonton, 24 miles northwest of Edson town and is 33 miles southwest of the same team's Windfall 12-36 D3 zone of Devonian wet gas discovery well.

The test was run of a 40-ft. interval in the bottom portion of the zone around the 11,100-ft. mark and crew has now cored ahead another 25 ft. and is currently conducting a further drill-stem test.

Cardium Hit Hinted Near Alhambra Field

A venture being drilled by Amerada Petroleum Corp. on a 6,306 acre drilling reservation farmout acquired from the California Standard Co. in the central sector of Alberta, 40 miles northwest of Red Deer and 4½ miles northwest of a Texaco Alhambra oil producer has recorded an oil show during a drill-stem test in the Cardium sand.

This show was recorded at the Amerada - Cal - Standard - Crown 6-6 "AP" wildcat test, located on LSD 6, 6-43-6w5, during a drill-stem test of the interval 6,055 to 6,100 ft. Recovery on that 60 minute test consisted of 470 ft. of oil and gas-cut mud, no water or free oil.

Crew on this well is currently drilling ahead looking for production possibilities in the Viking sand. Latest reported depth was 6,611 ft.

Blairmore Discovery Hinted At Verlo Area Wildcat

The three company team headed by Mobil Oil of Canada, Ltd., and including Woodley Canadian Oil Co., and Southern Production Co., Inc., has

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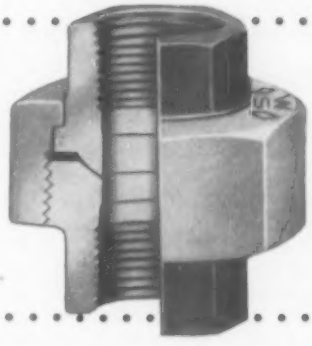

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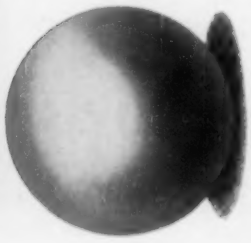

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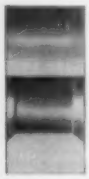

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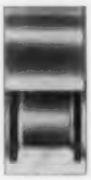
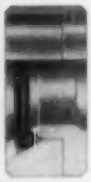
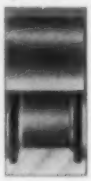
For harder than usual pumping — double contact with the ball.



"O-Ring Seal"
A 2-piece stainless steel seat specially recommended where ordinary or fracturing sand is causing seat failures.



"Sheralloy" Seat
A cast alloy definitely proved resistant to corrosion. Also good for hard pumping.



For best service use the right Baird ball with the right Baird seat.

flowed oil from an undetermined sand in the Blairmore formation while conducting drill-stem tests around the 3,150 ft. level. This wildcat venture is 11 miles west of oil production in Cantuar oil field and 3 miles west of the Mobil-Woodley-Southern 9-14 Antelope Lake Blaimore zone gas discovery well.

This strike, Mobil-Woodley-Southern 27-4 Verlo, on LSD 4, 27-16-19w3, as well as flowing oil to the surface also recorded an 8,000,000 cu. ft. daily gas blow from the same zone. Initial test, the one that recorded the gas flow was of the interval 3,155 to 3,165 ft. A 10-ft. oil recovery was also made on that test. The next test, of interval 3,164 to 3,175 ft. flowed oil in 9 minutes and during a 31-minute test the well flowed at the rate of 1,800 bbl. of crude daily, through a ⅝-in. choke. Pipe recovery was 3,160 ft. of clean, 21.9°-gravity oil.

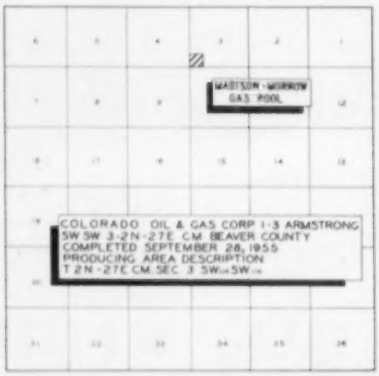
The 10-ft. section immediately below that test, bottomed at 3,185 ft., was also tested. It gave up a pipe recovery of 2,540 ft. of gassy oil and 600 ft. of salt water.

HUGOTON EMBAYMENT

OKLAHOMA PANHANDLE

Distillate Tested at New Beaver Discovery

Parker Petroleum Co. 1 Mitchell, C SE NW 3-1n-23eCM, new Beaver County Morrow gas-distillate strike, flowed 21,000 M.c.f. of gas per day and 8 bbl. of distillate per million on test of the interval 7,634-44 ft. in the Morrow sand. This is the latest in the growing list of gas-distillate areas popping up in south-central and southwestern Beaver County. These two sections of the Oklahoma Panhandle currently lead all Hugoton embayment regions in exploratory interest.


MADISON - MORROW GAS POOL
COLORADO OIL & GAS CORP 1-3 ARMSTRONG
SW SW 3-2N-27E CM BEAVER COUNTY
COMPLETED SEPTEMBER 28, 1955
PRODUCING AREA DESCRIPTION
T 2N - 27E CM SEC. 3 SW¼ SW¼

Producing area description of Madison-Morrow gas pool in southeastern Beaver County, one of the exploratory highlights of 1955 in the Oklahoma Panhandle.

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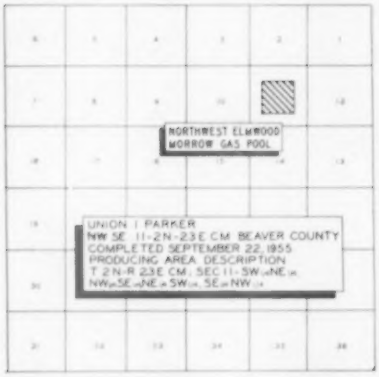
NORTHWEST ELMWOOD
MORROW GAS POOL
UNION 1 PARKER
NW SE 11-2N-23E CM BEAVER COUNTY
COMPLETED SEPTEMBER 22, 1955
PRODUCING AREA DESCRIPTION
T 2 N-R 23 E CM, SEC 11- SW¼NE¼
NW¼SE¼NE¼ SW¼ SE¼NW¼

Producing area description of Northwest Elmwood - Morrow gas pool in southern Beaver County, the most important 1955 strike in the Oklahoma Panhandle.

NORTHWEST OKLAHOMA

Hoover Gas Proved at Laverne Area Wildcat

Sun Oil Co. 1 Carlisle, C SW NE 25-26n-25w, Harper County, flowed 5,400 M.c.f. of gas per day on drill-stem test of the Hoover sand at 4,145-4,211 ft.

Elsewhere in Harper County An-Son Petroleum 1 Freeman, C NW NW 6-27n-25w, northwest of Northeast Laverne field, flowed 500 M.c.f. of gas per day on drill-stem test at 6,513-63 ft.

MID-CONTINENT

NORTH TEXAS

Taylor County Drilling Running High

Taylor County activity during the week included one opener completed and a number of new discoveries getting confirmation wells.

S. C. Herring Drilling Co. 1 Teaff has been completed as a Capps Limestone discovery, flowing 106.7 bbl. of 42° oil a day. Drilling reports classed the well as a reentry, but did not give old total depth.

The recompletion potential was through 16/64-in. choke from pay at 4,418-26 ft. Tubing pressure was 180 psi. and gas-oil ratio was 380:1. Nearest Capps production was reported as being 15 miles away. Location is in the W. B. Hardin Survey 130, 3 miles northwest of the town of Capps.

Superior Oil Co. 1 Cartwright, one location south of Herring Drilling Co. 1 Cartwright, discovery well in southern Taylor County, has been completed for 115 bbl. of oil a day from the Gardner sand. Production was through 17/64-in. choke, from perforations at 4,532-46 ft. Gas-oil ratio was 400:1, and tubing pressure was 360 psi.

A Gray sand confirmation well was finished, 2 miles south of Lawn. Joe T. Nix 1 Heathley, north offset to Ophelia Gogle 1 Heathley, discovery, perforated the sand at 4,050-57 ft. and completed for 288 bbl. of oil a day. Production was through 16/64-in. choke; 42° oil, with gas-oil ratio of 750:1.

Tide Water Associated Oil Co. 1 Viola Jones, also a Gray sand confirmation well, completed flowing 444 bbl. of 40° oil a day. Production was from perforations at 4,872-78 ft., through ¼-in. choke, and with gas-oil ratio of 968:1. Location is in the S. A. Griffith Survey, 17 miles southwest of Abilene and a west offset to the original discovery.

Frippen prospect . . . Drill Well Oil Co. 1-C Sayles, wildcat in the 20-4-T&P Survey, 7 miles southwest of Buffalo Gap in east-central Taylor County, had oil at the surface in 37 minutes on a drill-stem test at 2,605-39 ft. The well did not flow but unloaded oil after the tool was closed. Another test of the Flippen, from 2,638-44 ft., had oil at the top in 1 hour and 50 minutes. Operators were running pipe to complete.

These Securities have not been and are not being offered to the public. This advertisement appears as a matter of record only.

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PACIFIC COAST

Signal Starts Second Redondo Beach Test

Signal Oil & Gas Co. was drilling below 2,115 ft. on 2 Sarcorb, the second test of Redondo Beach's tidelands. Signal extended production of the neighboring Torrance field when it completed the first offshore wildcat for a new pool discovery recently. The discovery, which was slant-drilled from an onshore site within the Redondo Beach city limits, was brought in flowing 172 bbl. daily of 25.6°-gravity crude. The producing interval is 2,850-3,098 ft. on this test which total depth at 4,036 ft.

Bandini Gets Fault Block Find

General Exploration Co. chalked up a new fault block discovery in Bandini field, Los Angeles County, with completion of the 7,100 ft. 15 C.W.O.D. The operator plugged back to 5,030 ft. before perforating between 4,918 and 5,029 ft. for the completion. The well flowed 339 bbl. daily of 42.3°-gravity crude through a 14/64-in. choke.

Gilliland Hits New Avenal Sand Pool

Gilliland Oil Co. gave Devils Den field, Kern County, another new pool discovery in the Avenal sand. Gilliland completed 1 Bandini-U.C. in the Daggany Gap area of the field for initial production of 144 bbl. daily of 40.5°-gravity crude through a ½-in. choke. The well sanded up shortly after completion but the operator was able to clean it up and the well was put back on production flowing and pumping 50 bbl. daily. The perforated interval includes all of the Avenal sand found in the field between 3,602 and 3,668 ft. The well was taken to 4,007 ft. and then plugged back to 3,668 ft. It is located SE. NW 3-25s-18e.

Texaco Taps Santa Fe Pool

The Texas Co. became the fourth company to tap the new Santa Fe pool in the old Santa Fe Springs field, Los Angeles Basin. Texaco completed 9 Wilckman flowing 1,614 bbl. daily of 31.6°-gravity crude through a 74/64-in. choke. Production is from 1,026 ft. of the new zone between 8,042 and 9,068 ft. Since completion, the choke has been set back to 36/64-in. with present production averaging 1,062 bbl. daily. Location of 9 Wickman is about 1,000 ft. northeast of General Petro-

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leum Corp. 243 Santa Fe, the deep zone discovery well. GP has three wells in the zone while Bandini Petroleum Corp., Rothschild Oil Co. and Texaco have one each.

Possible Gas Find for Texaco

The Texas Co. may have scored a new gas pool discovery in the Georgiana Slough area, Sacramento County, about 1 mile northeast of the Rio Vista field. Texaco was preparing to run casing in the 4,750 ft. 2 Arthur Brown after running an electric log. Drill site for this wildcat is located NE NW 11-4n-4e.

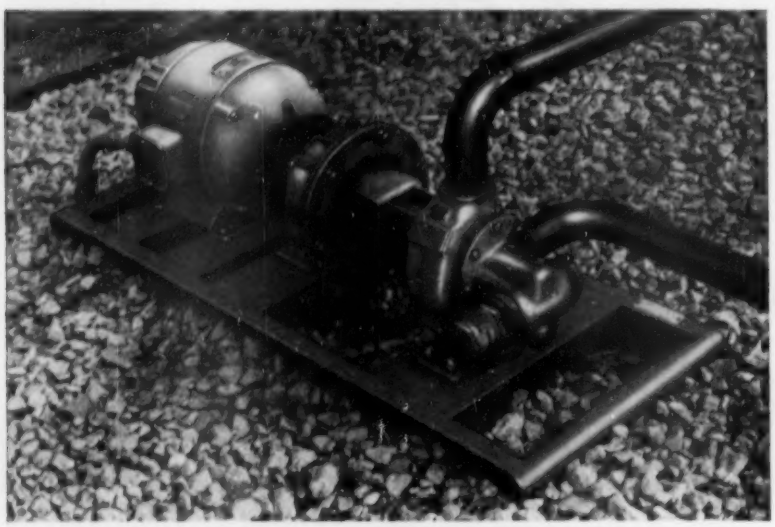
GREAT LAKES

MICHIGAN

A Dundee oil pay was being tested natural at an Oceana County wildcat located 14 miles southeast of the Pentwater Traverse and Dundee oil pool, Ottawa County, and 7 miles northwest of Traverse oil pool, Newaygo County, this week.

New oil-showing wildcat was the McClure Oil Co. 1 Studabaker, NE NW NW 16-15n-15w, Leavitt Township. Well carried 550 ft. of free oil natural in 40 hours, plus about 125 ft. of water. Water was described as being fresh and was believed to have been balance of drilling water left in hole when casing was set. Pump testing, with no results announced, was in progress.

• A deeper zone oil pay, logged about 77 ft. below top of Dundee, was undertest in the Southwest Michigan province at the Miller Brothers 1 Siemion, NE SE SW 3-7n-15w, Robinson Township wildcat, Ottawa County. Well swabbed and flowed an average of 8 bbl. of oil a day natural on initial tests after a long string of 3-in. casing was set to 2,106 ft., total depth, with packer at 2,102 ft. Both 4 ft. of casing was perforated. An initial 175-gal. acid treatment was called ineffective. Pressures did not exceed 500 lb. on this treatment due to concern for packer casing seat.



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ROCKY MOUNTAIN

WYOMING

Gas Discovery Reported At Twin Rocks Wildcat

Carter Oil Co. has a Frontier gas discovery in the Twin Rocks Unit of Sweetwater County, on the western flanks of the Rock Springs uplift. The discovery well, 1 Twin Rocks unit, C SW SW 29-21n-103w, flowed 2,700 M.c.f. of gas per day from perforations at 3,985-97 ft.

Location of the new producer is 8 miles north of North Baxter Basin field, a Dakota, Morrison, and Nugget gas producer.

WESTERN NEBRASKA

"D" Sand Discovery Finaled in Kimball

Kimball County has a new "D" sand discovery area. The discovery well is Roh Oil Co. and Walker-Wilson Drilling Co. 1 Swisher in C NW SW 5-13n-54w, ¾ mile north of Vrtatko field, but separated by a failure.

The well made 112 bbl. of oil per day from perforations at 6,008-10 and 6,009-12 ft.

Morrill County Gets Third New '56 Field

Nebraska continues its lead over other Rocky Mountain province drilling areas with the third new pool this year in Morrill County. Skelly Oil Co. 1 Lindberg, NW NW SW 11-17n-52w, recovered 3,150 ft. of gas-cut oil and 30 ft. heavily oil-cut mud on a 2-hour drill-stem test of the "J" sand at 5,214-24 ft.

This new field discovery prospect is

located 1½ miles northwest of Juelfs field, a Cheyenne County producing area. The 1 Lindberg opens the fifth producing area for Morrill County, one of the newcomers to Nebraska's producing column.

Since January two other fields have been opened in this county. In January Ohio Oil Co. 1 Lane, C NW SE 17-17n-49w, made 35 bbl. of oil per day. In April British-American Oil Producing Co. opened a new field at 1-D Craig in C NW SW 23-19n-52w, for 203 bbl. per day. The county's big producer is a 1955 discovery, Olsen field. This Superior Oil Co. discovery area is in 18n-52w. The field has more than 25 producing oil wells. It crosses the county line into Banner.

COLORADO

Extension Try Under Way at Jackson Pool

Cabeen Exploration Co. 2 Blevins, the extension well to the gas discovery at 1 Blevins, is below 453 ft. in NW SE SE 3-9n-78w, Jackson County.

This North Park basin discovery area was opened 2 weeks ago at 1 Blevins in SW NE NW 11-9n-78w. The well is shut in following a flow of 2,500 M.c.f. of gas per day from the Frontier. Total depth of the discovery well is 1,593 ft. Location is 4½ miles east of North McCallum field.

Raton Basin Field Trip Announced By R.M.A.G.

The Rocky Mountain Association of Geologists plans a field trip next autumn through the Raton basin and adjoining areas of southern Colorado and northeastern New Mexico.

The trip will cover the Wet Mountains, Huerfano Park, the Raton basin, Sangre de Cristo Mountains, Apishapa uplift, Sierra Grande uplift, Purgatoire River Canyon, and adjoining areas. Papers and lectures will cover the general geology of the area and places of interest on uranium and petroleum exploration.

The trip will begin September 26, lasting through the 28. For registration and reservations contact: Lou Perry, in care of Pure Oil Co., 404 Ross Building, Denver 2. Phone KEystone 4-2243.

ARIZONA

Two Wildcat Locations Staked

Hancock Oil Co. and Franco Western Oil Co. have staked locations for wildcats in the Four Corners region of Apache County. Hancock will drill a 6,500 ft. test in NE NW 29-41n-27e. This is about 10 miles southwest of Humble Oil & Refining Co.'s 1 Navajo Trail which was completed last year as Arizona's first oil well. Franco's test will be a 6,000 ft. wildcat in the north Toh-Atin region in SW NW 22-41n-28e, which is about 3 miles south of Humble's discovery.

NORTHWEST COLORADO

North Douglas Creek Discovery Is Finaled

Completion was reported at the important North Douglas Creek Weber-Penn discovery in Rio Blanco County. Phillips Petroleum Co. 1 "A" Douglas, E½ NW NE 19-1s-101w, was finaled for 92 bbl. of oil and 21 bbl. of water per day from Weber sand perforations at 7,517-75 ft.

NORTHWEST NEW MEXICO

Humble Completes Paradox Basin Strike

Humble Oil & Refining Co. completed its southeastern Paradox basin discovery, the 1-B Navajo in C NW SW 29-32n-20w, San Juan County. The well flowed 385 bbl. of oil in 21 hours from perforations in the Paradox at 5,608-32 ft.

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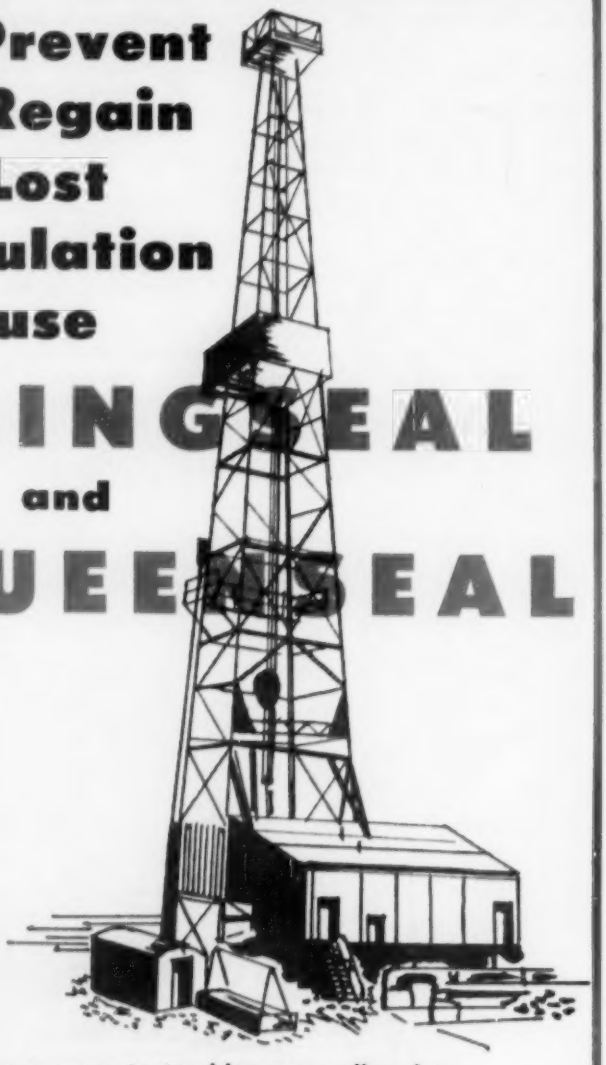

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UTAH

Aneth Area Paradox Producer Completed

Superior Oil Co. completed the 1 Navajo-A well in San Juan County's Aneth area, the most significant new discovery area on the west side of the Rockies. The big well made 615 bbl. per day on 48/64-in. choke. Location of the closely watched confirmation well to the new area is SW SE 14-20s-24e.

The Texas Co., discoverer of this area, also has success hinted at a third well in the new field of high promise. The 1 Navajo-E, NW SE SE 15-40s-24e, recovered 2,096 ft. of free oil, 140 ft. of heavily oil and gas-cut mud, and 140 ft. slightly mud-cut oil in 4½ hours. The test was at 5,574-5,683 ft.

Another well in the area, the 1 Navajo D, NW SW NE 22-40s-21e, flowed at the rate of 45-55 bbl. per hour on tests at 5,847-97 ft. The Texas Co. has set pipe and is waiting on cement.

Successful Wildcats

WEST TEXAS

Cochran County: Gulf Oil Corp. 6 Jax Cowden, 33-2-H&TC, 10 miles SW Crane. IPP 44 BOPD, 44°, GOR 520, Lower Permian 4,445-4,510 ft. TD 6,240 ft.

Gaines County: Husky Oil Co. 1 Wimberly, 315-G-CCSD&RGNG, 10 miles NW Seminole. IP 408 BOPD, ¼-in., TP 170 psi., GOR 36, 28.6°. Canyon perforations 12,240-50 ft. TD 12,920 ft., elev. 3,459 ft.

Irion County: British American and Atlantic Refining 1 Noelke, Tom Green CSL, 10 miles SW Mertzon. IP 207 BOPD, 16/64-in., TP 365 psi., GOR 1689, 53.8°. Strawn reef perforations 6,898-6,908 ft. TD 7,514 ft., elev. 2,373 ft. Cambrian sand top 7,464 ft.

Reagan County: Texas Gulf Producing Co. 1-S University, 7-11-ULS Sur., W of Big Lake Township. IP 54.8 BOPD, ¼-in., TP 300-150 psi., GOR 2,409, 44°, Fusselman 9,248-70 ft. TD 9,620 ft.

Runnels County: Hoblitzelle & Perkins 2-A Herring, 35-62-H&GN, 7 miles SE Norton. IPP 147 BOPD, 42°, GOR 50, Canyon sand 3,389-93 ft. TD 3,440 ft.

Joe Rolls 1 Harris, Carter Anderson Sur. 523, 7 miles S Winters. Originally completed dry at TD 4,703 ft. PB 4,105 ft., Palo Pinto pay 3,432 ft., IPP 43 BOPD, 42.8°, GOR 410.

Sterling County: Robinhood Oil Co. 1 McEntire, 5-T-T&P, 6 miles W Sterling City. IPP 27 BOPD, 31°, San Andres 1,648-59 ft. TD 2,145 ft.

WEST CENTRAL TEXAS

Haskell County: Amarillo Oil Co. and C. D. Speed 1 Fletcher, Wise CSL Sur. 76, 3 miles SW Rochester. IPP 66 BOPD, 38°, GOR 450, conglomerate 5,775-85 ft. TD 5,825 ft.

Thomas D. Humphrey & Sons 1 Williams, J. F. Morgan Sur. 59, 5 miles NE Stamford. IPP 126 BOPD, 38°, GOR 245, King sand 2,305-12 ft. TD 2,573 ft.

Nolan County: Sinclair Oil & Gas Co. 1

McAdams, 60-22-T&P, ½ mile SE Sweetwater. IP 304 BOPD, ¾-in., TP 25 psi., GOR 290, 47°, Ellenburger 6,484-96 ft. TD 6,510 ft. Elev. 2,170 ft.

NORTH TEXAS

Archer County: J. C. Man, Jr. 1 Lindeman, Blk. 4, Clark & Plumb, 3 miles W Windthorst. IPP 133 BOPD, 42°, Strawn 3,606-21 ft. TD 3,621 ft.

Ted A. Norwood 1-A Shown, Jesse Irvine Sur., A-312, 10 miles SE Antelope. IPP 40 BOPD, 39°, GOR zero, pay 2,369 ft. TD 2,373 ft.

Trice Production Co. 1 Sewell, J. B. Irvine Sur., A-312, 9 miles SE Antelope. IPP 72 BOPD, 38°, GOR 100, Buttram sand 2,750-54 ft. TD 3,575 ft.

Wilbarger County: Noel Pautsky 1 Ancell estate, 35-6-H&TC, 10½ miles S Electra. IP 76 BOPD, 8/64-in., TP 100 psi., 40°, GOR 200, Canyon sand 2,676-91 ft. TD 2,691 ft.

Wise County: Cities Service Oil Co. 1-E Tarrant, J. G. Clayton Sur., A-750, 4½ miles SW Chico. IP 260 BOPD, 36/64-in., TP 280 psi., 44°, GOR 3600, Atoka conglomerate 5,794-5,806 ft. TD 6,025 ft.

SOUTHEAST NEW MEXICO

Chaves County: Leonard Oil Co. 2 Hobbs, 23-15s-30e. IPP 96 BOPD, 34°, TP 540 psi., GOR 3805, Queen sand 2,770-77 ft. TD 2,778 ft.

Lea County: Shell Oil Co. 1 Hooper, 27-19s-35e. IP 137 BOPD, 15/64-in., TP not reported, GOR 840, 37.7°, pay 8,198-8,272 ft. TD 13,950 ft.

Sunray Mid-Continent Oil Co. 1-F State, 1-10s-33e. IP 341 BOPD, 14/64-in., TP 1300 psi., GOR 2000, 45.7°, perforated 9,645-56, 9,694-9,700, 9,734-46 ft. TD 12,637 ft., elev. 4,262 ft.

TEXAS GULF COAST

Colorado County: Shut in gas well. Great Lakes Carbon Corp. 10-A L. E. Brownson, E. S. Wooley A-584. perfs. 3,202-08 ft. TD 8,844 ft.

Liberty County: John W. Mecom 1 Barngrover estate et al., H&TC 176 (C. F. Stephens) A-778, 2 miles N of Raywood townsite, 2¾ miles NE of Raywood production. IPF 70 BOPD, 10/64-in. choke, GOR 2,840:1, perfs. 9,626-46 ft. 39.9°, TD 11,081 ft. (Oil discovery well.)

SOUTHWEST TEXAS
(District 4)

Hidalgo County: Houston Oil Co. of Texas 1 Walter C. Bandemer et ux., Sec. 184, West Tr. Subd. Farm Lot 343. IP Shut in gas discovery, top pay 9,592 ft. 52.6°, perfs. 9,592-9,604 ft. TD 10,300 ft. New pay gas well in South Elsa field.

Nueces County: Morgan Minerals Corp. 3 Cody estate "A," J. H. Smith Sur. 25, A-305. IPF 168 BOPD, 4,035-38 ft. in 4,000-ft. sand, 24°, 13/64-in. choke. TD 4,291 ft. (New pay in Cody field.)

SOUTHWEST TEXAS

Val Verde County: Magnolia Petroleum Co. 1 L. M. Morrison, TCRR Sur. 10 Blk. Q-4, 20 miles southeast of Samuels, Tex. IP 1,250 M.c.f. of gas per day, dry, open flow, perfs. in Ellenburger at 13,944-14-062 and 14,168-14,946 ft. TD 15,143 ft. (Dry gas strike in Val Verde basin.)

TEXAS MIDDLE GULF COAST

Live Oak County: H. R. Smith 1 Will Hinnant, Edward Brunett Sur., 20 miles southeast of George West. IPF 24 BOPD, 20/64-in. choke, top upper Hockley pay 4,439 ft. perfs. 4,439-54 ft., 48°, TD 4,650 ft.

OKLAHOMA

Grant County: Powell Briscoe, Inc. 1 Wyckoff, 2½ miles south of South Prairie Home field in C NE NW 25-28n-6w. IPF 48 BOPD, Bartlesville 4,750-62 ft., 21,917 M.c.f. of gas per day, open tubing, TD 4,781 ft. (Gas-distillate discovery.)

SOUTH LOUISIANA

Jefferson Davis Parish: Sun Oil Co. 1 Miller, 22-10s-3w. New pay and extension to South Jennings field. IPF 109 BOPD, and 2,461 M.c.f. of gas per day, GOR 15,098:1, 49.4°, perfs. 12,356-66 ft. 8/64-in. choke. TD 14,000 ft. (Gas-distillate well.)

Cameron Parish: Offshore. Mecom Petroleums 7-A State Lease 1133. West Cameron Block 45. New oil pay discovery. IPF 274 BOPD, 127 M.c.f. of gas per day, 10/64-in. choke, 38°, GOR 462:1, perfs. 9,266-70 ft. TD 10,122 ft.

ARKANSAS

Nevada County: C. G. Davis 1 Page 1¾ miles SW of Willisville, 1½ miles SE of West Willisville field in 30-14s-21w. IPP 21 BOPD, 14.6°, Nacatoch sand 1,208-14 and 1,217-24 ft. TD 2,310 ft. (Discovery of Southwest Willisville field.)

Union County: Cotton Valley discovery in Beech Creek field. Gulf Refining Co., Jones-O'Brien, Inc., and Tandem Drilling Co. 1 Burdine, ¾ mile northeast of Wesson, ⅞ mile northwest of Beech Creek discovery well in C SE SE 28-18s-

Another

WISCONSIN-POWERED
SALT WATER
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PUMPING
UNIT

Wherever there's a salt water disposal job that needs to be done, you will find a made-to-order assignment for a Wisconsin-powered pumping unit. Forcing the salt water back into the porous ground formation under pressure calls for an engine of basic *high torque design* . . . engineered to "take it" hour after hour, day after day, under either variable or constant load operation.

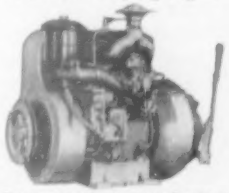
Wisconsin Heavy-Duty Air-Cooled Engines have the inbuilt stamina and dependable *Lugging Power* that *hangs on* and keeps the equipment going in all kinds of weather, under all climatic conditions . . . with an absolute minimum of maintenance service.

Whether the job calls for salt water disposal pumps, oil well pumps, gathering pumps, pipe wrapping machines, dope kettles, trenchers, standby power units . . . or any other applications that call for heavy-duty engine power within a 3 to 36 hp. range . . . there is a Wisconsin Engine of the right size to handle the assignment with maximum power advantage and lowest cost maintenance.

Wisconsin Heavy-Duty Air-Cooled Engines have proved themselves in oil field service continuously for almost twenty years. You can't go wrong when you specify "WISCONSIN" for your oil field utility units.

This salt water disposal pumping unit is powered by a 3½" x 4" V-type 4-cylinder Model VG4D Wisconsin Engine and is operated by a major petroleum company in Osage County, Okla.

Model TFPD Wisconsin Oil Well Pumping Engine



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This announcement appears for purposes of record only.

NEW ISSUES

$112,500,000

WESTCOAST TRANSMISSION COMPANY LIMITED

$83,000,000 (U. S.) First Mortgage Pipe Line Bonds, 4¾% Series (Series A) due 1977

$10,500,000 (Canadian) 3½% Debentures Maturing Semi-Annually from 1959 to 1963

$19,000,000 (U. S.) 3½% Notes Maturing Semi-Annually from 1959 to 1963

Direct placement of these securities with institutional investors has been negotiated by the undersigned.

EASTMAN, DILLON & CO.

April 25, 1956

This is under no circumstances to be construed as an offering of these Securities for sale, or as an offer to buy, or as a solicitation of an offer to buy, any of such Securities. The offer is made only by means of the Prospectus.

NEW ISSUE

WESTCOAST TRANSMISSION COMPANY LIMITED

***$20,500,000 (U. S.) THIRTY-TWO YEAR 5⅛% SUBORDINATE DEBENTURES**
DUE APRIL 1, 1988

***615,000 SHARES WITHOUT NOMINAL OR PAR VALUE OF CAPITAL STOCK**

Offered in Units Consisting of $100 Principal Amount of Debentures and 3 Shares of Capital Stock

Each Unit will be represented by $100 principal amount of temporary Debentures and 3 shares of Capital Stock. Units may be issued or combined in authorized denominations as stated in the Prospectus. Temporary certificates for shares of Capital Stock included in the Units will have on the reverse side thereof the temporary Debentures included therein and until such temporary Debentures and stock certificates are exchanged for definitive Debentures and Capital Stock certificates, such Debentures will be transferable only together with such shares of stock. It is expected that definitive Debentures and share certificates will be available on or about December 31, 1957.

PRICE $115 (U. S.) PER UNIT
PLUS ACCRUED INTEREST ON THE DEBENTURES

Copies of the Prospectus may be obtained from such of the undersigned as may legally offer these Securities in compliance with the securities laws of the respective States.

EASTMAN, DILLON & CO.

THE FIRST BOSTON CORPORATION — **SMITH, BARNEY & CO.** — **BLYTH & CO., INC.**

DREXEL & CO. — **GLORE, FORGAN & CO.** — **GOLDMAN, SACHS & CO.**

HARRIMAN RIPLEY & CO. Incorporated — **KIDDER, PEABODY & CO.** — **LEHMAN BROTHERS**

MERRILL LYNCH, PIERCE, FENNER & BEANE — **STONE & WEBSTER SECURITIES CORPORATION**

UNION SECURITIES CORPORATION — **WHITE, WELD & CO.** — **DEAN WITTER & CO.**

April 25, 1956

*Of which 20% are being offered in Canada by Wood, Gundy & Company Limited, Nesbitt, Thomson and Company, Limited and Norman R. Whittall Limited.

These securities have been sold through the undersigned and are not offered for sale. This advertisement appears as a matter of record only.

NEW ISSUE

$16,355,000

WESTCOAST TRANSMISSION COMPANY LIMITED

3,271,000 SHARES WITHOUT NOMINAL OR PAR VALUE OF CAPITAL STOCK*

EASTMAN, DILLON & CO.

April 25, 1956

**See Voting Trust Certificates in respect of certain thereof.*

16w. IPP 23 BOPD, Cotton Valley 6,609-18 ft., 34°. TD 7,920 ft.

ALBERTA

Imperial 12-1-40-1 Bentley, LSD 12, 1-40-1w5. TD 5,607 ft. Viking oil well.

Gulf Mobil 9 Klingstal, LSD 9, 23-33-26w4. TD 7,550 ft. D2 oil well.

CALIFORNIA

Kern County: Gilliland Oil Co. 1 Bandini-U.C., SE NW 3-25s-18e, 144 BOPD, 40.5° gravity, 22/64-in. choke, 1 per cent cut, perfs. 3,602-68 ft., TD 4,007 ft. (New pool discovery Alferitz Anticline area of Devils Den field, Kern County.)

Los Angeles County: General Exploration Co. 15 C.W.O.D., SE NW 17-2s-12w, 339 BOPD, 42.3° gravity, 14/64-in. choke, 1.5 per cent cut, perfs. 4,918-5,029 ft. TD 7,100 ft. (New fault block discovery Bandini field.)

Signal Oil & Gas Co. 1 Signal-Artnell-Reserve-City of Redondo Beach, SW SW 6-4s-14w, BOPD 172, 25.6° gravity, 15 per cent cut, perfs. 2,850-3,098 ft., TD 4,036. (New pool discovery offshore from Torrance field.)

NORTH DAKOTA

McKenzie County: Amerada Petroleum Corp. 1 Albert Anderson, SE NE 6-152n-95w. IPF 351 BOPD, Madison discovery, new field. TD 9,063 ft. Madison.

S.E.G. Announces Mayhew Scholarship in Geophysics

The Society of Exploration Geophysicists announces the Mayhew scholarship in geophysics. This $3,000 scholarship has been established to enable a young man or woman to become a geophysicist. It provides $750 per year for 4 years toward the cost of tuition and laboratory fees, etc. It must be in a college or university that offers a bachelor's degree in geophysics. The S.E.G. has accepted the responsibility of awarding the scholarship.

Eligibility for application . . . A son or daughter of a person who is totally engaged in the geophysical industry, either a geophysical company, a geophysical branch of an oil company, or a contract drilling company who is:

1. A senior or postgraduate student in high school.

2. A student who expects to complete his work in high school at some time between now and June of this year.

3. A student who intends to prepare himself for a career in geophysics.

4. A student who is willing to concentrate in geophysics for at least 4 years of college work, following a plan that will lead to a bachelor's degree.

Applications may be obtained from: F. J. Agnich, 5900 Lemmon Avenue, Dallas 9. These applications must be filed before June 1, 1956. Application blanks may also be secured from the Scholarship Committee, S.E.G., Box 1536, Tulsa.

Greener pastures beckon . . .

. . . Parker Drilling Goes Abroad

FLEXIBILITY is the key to the success of Parker Drilling Co., which has proved its ability to operate successfully in good times and bad.

Boyish Bob (R. L.) Parker, the company's young president, says you have to be able to move fast to meet changing conditions.

A few years ago the company was running 60 rigs. But it saw the day coming when there would be too many rigs for the amount of work, a condition plaguing the industry today.

"We sold our rigs down to 30," Parker says, "and centralized them in the New Mexico, West Texas, and Oklahoma area to permit more efficient operations and closer supervision."

Parker's latest move also underlies this flexibility. Two management crews have been sent to Israel, and more may be put to work as drilling increases. Contract rigs will be shipped later if developments warrant. Parker is also discussing deals to drill in several other foreign countries.

The reason is simple: "There is a demand for more rigs abroad than are available."

Because of the trend away from company-owned rigs, Parker feels that there is an opportunity to make money now in foreign drilling, a field the company deserted a few years ago.

The company had rigs in Venezuela and Canada when they were booming.

Parker's career . . . Bob Parker was just 10 years out of the University of Texas when he took over as president of his father's company last year.

After earning a degree in petroleum engineering, with a geology minor, Parker entered the Army as a private. He served 2 years, including a year in Germany, and was discharged a second lieutenant in 1947.

He started roughnecking and later drilling for the family company at Brookhaven, Miss. Then came tours in West Texas as roughneck, driller, and field man. Returning to the home office at Tulsa, he was successively safety director, contact man, and operations manager, holding the latter job for 3 years before becoming president.

Parker Drilling is able to shift gears quickly because, although it is a big company, it has a small, tightly knit executive staff composed only of the president, operations manager, and three field superintendents who also are directors. G. C. Parker, Bob's father, who organized the company 21 years ago, is chairman of the board. While always available for counsel, he concentrates on his separate oil-producing business and two Hereford ranches.

Success formula . . . The younger Parker has a lot of definite ideas on how to run a drilling business, and he credits his father for developing the successful operating techniques.

He insists on good equipment, good personnel, and major company work. To these three he adds another factor—close personal supervision. Carrying out this policy keeps two planes busy.

Parker travels 3,000 to 5,000 miles a week, making every one of the 30 rigs at least once a month. A typical day finds him in Lovington, N. M., in the morning, lunching at Odessa, Tex., and back home that night.

Some contractors lean toward special tie-ups with certain companies. Parker holds to the opposite theory. "If one big account went bad, you'd be in trouble," he points out. But his company doesn't run this risk. Its 30 rigs are now working for 24 different major companies.

Hobbies, family . . . Despite his heavy traveling schedule, Parker is away from home nights surprisingly little.

He is able to spend almost a normal amount of time with his wife, Katherine Mae, and their two children, Bobby, Jr., 7, and Carol, 5.

He also pursues his hunting and fishing hobbies as vigorously as he runs the drilling business. A big grizzly trophy hulking over his office desk attests to Parker's hunting ability. Elk and moose trophies and other mementos from hunting trips all over North American line the walls of the Tulsa headquarters.

J. R. McChesney has been promoted to manager of Pure Oil Co.'s natural gas department. He replaces **Earl B. Sloan,** retiring after 39 years' service.

R. F. Higginbotham has been advanced by Sinclair Oil & Gas Co. from district superintendent in Odessa, Tex., to assistant division superintendent in Midland, Tex.

E. R. Osburn has been promoted by Union Producing Co. from staff geologist in Midland, Tex., to district geologist in Monroe, La.

Jack L. Mataya, staff geophysicist for Stanolind Oil & Gas Co. in Tyler, Tex., has been advanced to district geophysicist there. He'll direct activities in the East Texas and Abilene districts.

A. L. Roberts, general superintendent of operations for Texas Gas Transmission Corp., Owensboro, Ky., since 1949, has been elected a vice president. Roberts joined Missouri-Kansas Pipeline Co., predecessor of Texas Gas, as district superintendent in 1930. Earlier he was with the engineering and construction divisions of the Empire companies of Bartlesville, Okla.

Personals

Edward Scott, Jr., has resigned as production engineer for Skelly Oil Co. in Carthage, Tex., to join Gulf Oil Corp. in Borger, Tex.

C. M. Clarkson has been promoted by Amerada Petroleum Corp. from foreman in Seminole, Tex., to assistant district superintendent in Midland, Tex.

A. T. Hague, since 1938 assistant manager of the asphalt and heavy fuels department at the Standard Oil Co. (Ind.), Whiting refinery, has been promoted to department manager.

O. T. Lawhorn, chief geophysicist for Pan American Production Co. the past 10 years, has resigned to join the Chicago Corp. in the same capacity. He's been active in his field since his graduation from North Texas State College with a degree in physics more than 20 years ago.

Dr. John E. Powers, assistant professor of chemical engineering at the University of Oklahoma, has been awarded an $11,500 National Sicence Foundation research grant. Powers will conduct studies aimed at new methods of predicting the best barrier system arrangement for separation of liquid components. Before joining the O. U. faculty, he was with Shell Development Co. in Emeryville, Calif.

M. E. Witherspoon, assistant to the president of Plymouth Oil Co., Sinton, Tex., since 1954, has been promoted to West Texas - Eastern New Mexico regional supervisor. Witherspoon joined Big Lake Oil Co., a Plymouth subsidiary, in 1927. He transferred to Plymouth in Sinton in 1935.

E. L. Hildenbrand has been named engineering specialist in the engineering division of Humble Oil & Refining Co.'s Baytown refinery. Other new engineering appointments there: **R. F. Worth,** supervising engineer; and **W. L. Martin,** senior mechanical engineer. New promotions in the refinery's research and development division; **R. C. Halter** and **J. F. Mathis,** to research specialists; **Margie M. Nicholson** and **F. W. Lampe,** to senior research chemists.

Rocky Mountain Production Men Elect

The Rocky Mountain district of the American Petroleum Institute's Division of Production elected new officers at its recent annual meeting in Denver. Shown above, front row, left to right, are: R. W. Gemmer, Carter Oil Co., Billings, vice chairman for Montana; Wayne E. Glenn, Continental Oil Co., Denver, new district chairman; R. L. Armstrong, Oil Well Supply Co., Casper, vice chairman for Wyoming; and Homer Brown, Mud Control Labs, Denver, vice chairman for Colorado. Standing, left to right, are: D. C. Albers, Ohio Oil Co., Sidney, Neb., vice chairman for Nebraska; R. M. Churchwell, Ohio Oil Co., Findlay, Ohio, retiring district chairman; D. B. Harrell, Worley & Harrell Drilling Co., Williston, vice chairman for North Dakota; and A. W. Thompson, Houston, Tex., A.P.I. production vice chairman. Not shown: Walter Forbes, Daniel Insurance Co., Casper, honorary district chairman; Warren Taylor, El Paso Natural Gas Co., Salt Lake City, vice chairman for Utah; Gerald Binks, National Supply Co., Casper, secretary-treasurer; and D. T. Hoenshell, Mobil Producing Co., Billings, chairman of the district advisory committee. During the session citations for outstanding work were given to Churchwell, Brown, and J. J. Oldham, R. L. Manning Co., Casper.

Raymond Malinowski has been promoted by Arabian American Oil Co. from petroleum engineer in Dhahran, Saudi Arabia, to senior reservoir engineer in New York.

Charles N. Needham, former district geologist for Houston Oil Co. in Casper, Wyo., has joined Republic Natural Gas Co. of Dallas as geologist in the newly established Denver division office.

Robert L. Stack, with American Oil Co.'s Texas City, Tex., economics and process development sections since 1951, has been promoted to group leader, analytical division, research and development department.

Richard R. Von Hagen, president of Lloyd Corp., has been reelected to a second 1-year term as president of the Oil Producers Agency of California. Reelected vice presidents were: **F. W. Borden,** Sunray Mid-Continent Oil Co. vice president; **W. H. Geis,** consultant; and **H. D. Campbell,** president of Franco Western Oil Co. Also reelected: **S. E. Cavanaugh,** vice president of Pacific Western Oil Co., secretary-treasurer; **Verne Harrell,** vice president of Bankline Oil Co., assistant secretary-treasurer; and **Stark Fox,** executive vice president. **Rouse Simmons,** president of Bolsa Chica Oil Corp., **Tyler Woodward,** president of Southern California Petroleum Co. and **Ross McCollum,** president of National Oil Co., were elected new directors.

A. T. Anderson and **R. B. Kelly** have been named to head two new western region exploration divisions of Continental Oil Co. Anderson will supervise the Los Angeles basin exploration division. Kelly will head the new offshore division.

Alexander H. Chapman, since 1948 assistant to Arabian American Oil Co.'s vice president for government relations, has resigned to reenter the consulting business. Before he joined Aramco, Chapman was a partner in the petroleum engineering firm of Hoover, Curtice & Ruby. Earlier he headed Petroleum Administration for War's foreign production section.

Minor L. Fahrman, on special assignments with Standard Oil Co. of California since 1951, has been named assistant chief engineer of the California Oil Co.'s refining division, Perth Amboy, N. J. Fahrmann was one of a group of engineers who helped reactivate Iran's Abadan refinery in 1954. Earlier, he supervised building of cracking and reforming facilities at California Oil's Perth Amboy refinery.

Personals

C. R. Wood has been transferred by Permian Basin Pipe Line Co. from assistant superintendent in Rankin, Tex., to chief inspector in Andrews, Tex.

Herbert McCracken, senior petroleum engineer for Texas Railroad Commission's oil and gas division, will resign May 15 to join Ambassador Oil Corp., Fort Worth. **Bob Ray Harris,** who has been in the commission's Corpus Christi district office, replaces McCracken in Austin.

H. M. Van Clief, former head of Honolulu Oil Corp.'s California drilling operations, has been promoted to California division superintendent. He succeeds **H. S. Stark,** who retired recently after 33 years' service. **C. F. Meacham** moves up from head construction foreman to the newly created post of assistant superintendent.

W. M. Schul has been promoted by Phillips Petroleum Co. from district superintendent in Cut Bank, Mont., to division superintendent in Denver. He replaces **Claude E. Peavy,** who resigned. **W. L. Kitsman,** moved up from assistant western division superintendent in Midland, Tex., to succeed Schul in Cut Bank. Schul joined Phillips' production department in 1920. Kitsman joined the firm in 1936 as associate engineer.

Loyd Wagner, Warren-Bradshaw Exploration Co. district drilling superintendent, has been transferred from the Northern Oklahoma - Kansas district,

L. WAGNER

L. SCHROCK

Tulsa, to the West Texas-New Mexico district, Midland, Tex. **Levi Schrock,** tool pusher for the firm since 1951, has been promoted to drilling superintendent, West Central-West Texas district, Odessa, Tex.

W. A. Scott, Shell Oil Co., has been elected 1956 chairman of the American Institute of Mining, Metallurgical & Petroleum Engineers' Billings Petroleum section, Billings, Mont. Other new officers: **J. J. Wanner,** of George J. Greer, first vice chairman; **M. C. Anderson,** Northern Pacific Railroad, second vice chairman; and **E. J. Whitaker,** Northern Pacific, secretary-treasurer. Elected directors were: **H. L. Ambler,** Farmer's Union Central Exchange; **C. F. Hunkins,** Northern Pacific; and **H. E. Allen,** Carter Oil Co.

P. W. Shepherd, Sinclair Oil & Gas Co. district engineer, has been transferred from Midland, Tex., to Big Spring, Tex.

John W. La Rue has resigned as research engineer with Stanolind Oil & Gas Co. in Tulsa to join Amstutz & Yates, Inc., Wichita consultants.

Harvey L. Hurley has resigned as vice president of Great Basins Petroleum Co., Denver, to become an independent there.

Gerald O. Webb, Amerada Petroleum Corp. engineer, has been transferred from Williston, N. D., to Duncan, Okla.

W. M. (Bill) Peterson, Cities Service Oil Co. development geologist, has been transferred from Roswell, N. M., to Wichita Falls.

Gordon W. Duncan, assistant director of Esso Research & Engineering Co.'s products research division since 1953, has been named assistant manager of the office of scientific liaison. The office coordinates Esso Research with universities, scientific societies, and consultants.

P. E. S. A. Honors Past Leaders

Past presidents of Petroleum Equipment Suppliers Association were honored recently at the group's twenty-first annual meeting in Boca Raton, Fla. They are, left to right, front: W. L. Childs, Jr., who accepted a plaque for his father, W. L. Childs, Reed Roller Bit Co., first president of P.E.S.A., 1933-34; J. A. Crawford, Youngstown Steel Products Co., of California, 1934-35; A. W. McKinney, National Supply Co., 1948-49 (also accepted plaque for National's J. A. Geismar, 1935-36).

F. M. Mayer, Continental Supply Co., 1951-52 (also accepted plaque for Continental's W. J. Morris, 1936-37); A. G. Evans-Lombe, Parkersburg Rig & Reel Co., who accepted plaque for Parkersburg's J. M. Crawford, 1937-38; Rainey Elliot, Jones & Laughlin Supply Div., current president, who accepted plaque for J. L. Shakely, formerly of J&L, 1938-39; and F. F. Murray, Oil Well Supply Div., U. S. Steel Co., 1942-43.

Rear, left to right are: M. E. Montrose, Hughes Tool Co., 1955-56 (also accepted plaque for H. H. Glen, Emsco Manufacturing Co., 1945-47); D. D. Bovaird, Bovaird Supply Co., 1953-54; M. B. Jones, the S. M. Jones Co., 1952-53; T. Sutter, Baker Oil Tools, Inc., 1950-51; G. A. Thompson, Bethlehem Supply Co., 1949-50; F. J. Spang, Spang & Co., 1943-45; W. D. Wilson, Wilson Supply Co., accepted plaque for E. W. Gildart, Norwell-Wilder Supply Co., 1940-41; and Wharton Weems, treasurer of P.E.S.A., who accepted plaque for A. B. Judd, formerly of Republic Supply Co., 1947-48.

Not present: E. S. Dulin, Byron Jackson Co., 1939-40; E. W. Miller, formerly with American Iron & Machine Works Co., 1941-42; and R. S. Durkee, Lane-Wells Co., 1954-55.

Personals

I. G. Davis, since 1951 vice president of Mena Grande Oil Co., Gulf Oil Corp.'s Venezuelan production subsidiary, has been elected president. He succeeds **Hoyt Sherman,** resigning because of ill health after nearly 29 years' service. Davis went to Venezuela in 1935 as geophysicist for Gulf Research & Development Co. In 1939 he joined Mena Grande's geological department in Maracaibo, and a year later was transferred to Caracas. He was named Western division manager in 1948. Sherman started in Venezuelan Gulf Oil Co.'s New York production office. He went to Maracaibo in 1928 as assistant general agent, and was named Mena Grande's first general manager in 1938. He had been president 7 years.

I. G. DAVIS

Jesse O. Crowe has been transferred by Gulf Refining Co. from offshore zone drilling engineer, Morgan City, La., to zone drilling engineer in the Houston producing division, Shreveport.

L. A. Woodward, former president of Mid West Refineries of Grand Rapids, Mich., has been named administrative vice president of Kerr-McGee Oil Industries, Inc. Woodward had been with Mid West 12 years.

Martin Mears, Tide Water Associated Oil Co. drilling superintendent, has been transferred from Ventura, Calif., to San Francisco.

Joseph Nalle, Houston consultant, has joined the oil division of Houston's Texas National Bank as assistant vice president and petroleum engineer.

James F. Addington has been promoted to division production engineer in Sinclair Oil & Gas Co.'s new Fort Worth division, created by a recent split of the West Texas-New Mexico division into two separate units. Fort Worth personnel moving to the other new division at Midland, Tex., are: **Loren L. Ware,** former division landman, who'll be assistant division manager; **Richard C. Frawley,** former district landman, who becomes division exploration superintendent; **Fred C. Rogers,** division gas and gas products superintendent; and **William J. Rogers,** division petroleum engineer.

T. A. Voorhees has resigned as field inspector and engineer for North Dakota Geological Survey, Minot, to join Cardinal Drilling Co. as petroleum engineer in Bismarck, N. D.

Marc H. Lowrance, district landman for Sinclair Oil & Gas Co. in Oklahoma City since 1952, has been promoted to division exploration superintendent in Fort Worth.

K. E. Beall has been advanced by Phillips Petroleum Co. from vice president, economics, to the newly created post of vice president and petroleum consultant. He is succeeded by **C. E. Turner,** manager of the economics department's reservoir division since 1938. Beall joined Phillips in 1920 as a production engineer. He transferred to the economics department in 1925, has managed it since 1946, and was named vice president in 1948.

I. H. Hughes, former assistant to the production vice president of Mid-Continent Petroleum Corp., has been named the seventh vice president of Sunray Mid-Continent Oil Co. Since shortly after Mid-Continent merged with Sunray, Hughes has headed the company's salary policy committee and job training program. Before joining Mid-Continent he spent several years in Peru and Colombia as director of International Petroleum Co., Ltd.'s South American operations.

James E. Skidmore has resigned as engineer with Carleton D. Speed, Jr., Bowie, Tex., to become a consultant in Nocona, Tex.

Lloyd R. Drevescraft, former district geologist for Amerada Petroleum Corp. in Amerada, has joined National Cooperative Refinery Association as Rocky Mountain area chief geologist.

J. E. KASCH

Dr. John E. Kasch, coordination manager of American Oil Co.'s manufacturing department since January, has been promoted to research and development manager. He succeeds **Dr. Phillip C. White,** recently named research manager of Standard Oil Co. (Ind.), parent of American. Kasch joined the old Pan American Refining Corp. in 1942 as chemical engineer in Texas City, Tex. Later Pan American was absorbed as a refining affiliate, and in 1952, Kasch was named technical assistant to its president. **Dr. A. A. O'Kelly,** Texas City, has been promoted to the new post of research and development director, under Kasch.

James W. Vater has been transferred by Ambassador Oil Corp. from chief engineer in Fort Worth to division production superintendent in Oklahoma City. **J. D. Christner** has resigned as senior petroleum engineer for Stanolind Oil & Gas Co. in Abilene, Tex., to join Ambassador as chief engineer.

DEATHS

Adolphus H. Brewer, 72, pioneer in the Oklahoma and Texas oil industry, died April 10 in his White Oak, Okla., home. He retired 5 years ago as superintendent of Dyck Oil Co., Pampa, Tex. Earlier he had been superintendent of Stebbins Oil & Gas Co. and Gladys Bell Oil Co., Tulsa.

Marvin Homer Thomas, 47, for many years construction superintendent of the old Mid-Continent Petroleum Corp., died April 26 in Tulsa.

Frank E. Evans, 82, president of Southwestern Oil & Gas Co. and the Big-Four Oil & Gas Co., died April 24 in Pittsburgh.

G. F. Gephart, 57, comptroller of Standard Oil Co. of California, died April 24 in San Francisco. He had been with Socal since 1926, and comptroller since 1944.

James Beattie Smith, 55, vice president for marketing of D. X. Sunray Oil Co., died April 27 in Tulsa.

M. G. Miller, 63, assistant manager of The Texas Co.'s Oklahoma production division, died May 1 in Tulsa. He had been with Texaco 42 years.

Charles M. Dean, 80, Franklin, Pa., independent producer, died there April 29.

Cleo L. Jones, 56, mechanical engineer for The Texas Co., died April 26 in Los Angeles.

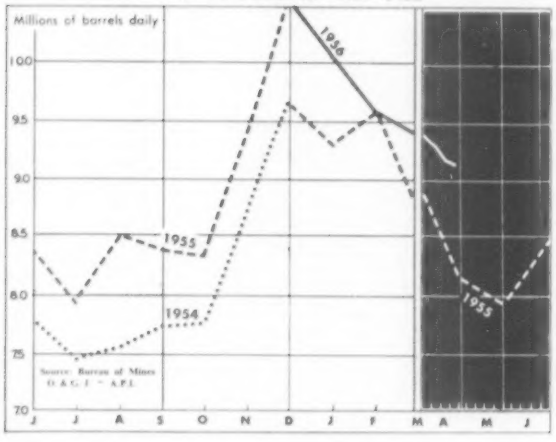
J. A. Deering, 76, Houston independent operator, died there April 30.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,162,600	DOWN	14,550	UP	462,220
Crude stocks	270,708,000	UP	3,623,000	DOWN	2,073,000
Completions	1,143	UP	2	UP	58
Refinery runs	7,447,000	UP	11,000	UP	288,000
Gasoline stocks	190,188,000	DOWN	2,745,000	UP	13,429,000
Kerosine stocks	17,894,000	UP	27,000	DOWN	3,118,000
Distillate stocks	61,923,000	DOWN	3,000	DOWN	5,712,000
Residual stocks	32,476,000	DOWN	353,000	DOWN	11,411,000
Four-product stocks	302,481,000	DOWN	3,074,000	DOWN	6,812,000
Total imports	1,140,800	DOWN	101,800	UP	91,700

TOTAL DEMAND—ALL OILS



New Premium Gasoline and Price Increases Highlight Oil Markets

GASOLINE markets are definitely in the spotlight at the beginning of May. Esso Standard Oil Co. announced a plan to market a 100-plus premium gasoline. Esso also stipulated minimum retail selling prices in New Jersey under the fair-trade laws of that state. Gasoline for Oklahoma delivery advanced May 1 with higher quotations for other areas expected.

The addition of a super premium gasoline to the normal motor-fuel line will result in many marketing shifts. In recent weeks, the cargo market on the Gulf Coast has seen a definite trend toward higher-octane premium grades. Normal premium which has been about 97 octane was at least partially replaced by either 98 or 99-octane grades.

If other marketers follow Esso's lead and start marketing two premium grades, the normal premium probably will settle back to 97 octane.

Regular grades on the Gulf Coast have been climbing toward 92 octane. If refiners have enough high-octane blending material to make 92-octane after compounding two premium grades, cargo shipments of regular to the East Coast may stay at this high level.

Refiners who have been large sellers of aviation-grade gasolines will have less aviation for sale if they market a super premium automotive fuel.

The use of aviation-gasoline components in the new premium will tend to create even tighter markets for these components. The scarcity of these high-octane materials will probably raise refiners' bids on aviation gasoline.

With high-octane fuel available at service-station pumps, automobile manufacturers will move toward still higher compression ratios. The end result will be a higher ratio of premium to total gasoline.

Some marketers are predicting that the two-grade-premium program will spread, first to the Gulf Coast and then up the Mississippi River to inland markets.

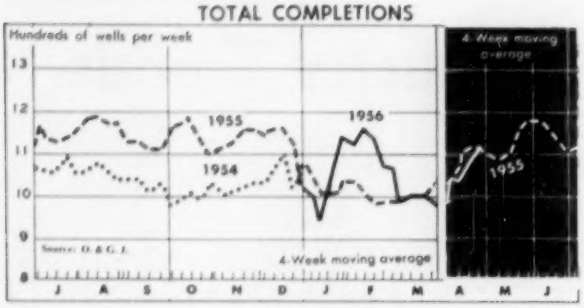
The State of New Jersey has been the center of gasoline price wars for many months. Esso Standard Oil Co. announced that effective April 30 it had established minimum retail prices for its branded gasolines in New Jersey under the fair-trade laws of that state. It set 25.9 cents and 28.9 cents per gallon for regular and premium grades respectively.

At the same time the company raised its price for regular gasoline to dealers by 1.4 cents a gallon to 14.9 cents exclusive of taxes. The wholesale price is still 0.6 cent below what Esso considers normal for the area. Other marketers met the increase in wholesale price but were reported to be studying the fair-trade provision. Shell Oil Co. announced that it had discontinued fair trading of products.

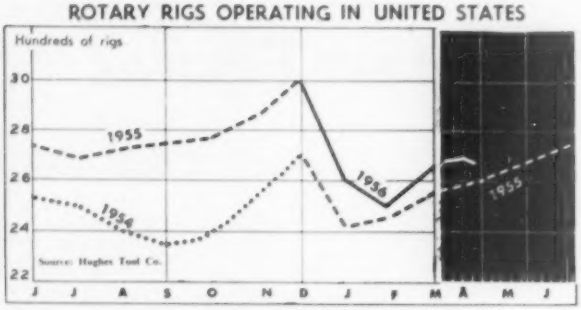
Several Oklahoma refiners have raised refinery-gasoline prices on material for delivery in Oklahoma. Regular gasoline is up 0.5 cent a gallon and premium up 0.75 cent. Higher-octane grades are available at all refineries for Oklahoma delivery.

Improved gasolines have been moving into the Great Lakes pipeline for several weeks, and the old grades have been worked off at most terminals. Pipeline gasoline prices are expected to increase by the amounts announced for Oklahoma. Since the new gasoline is available at most terminals, the price increase could come at any time but probably will start early in the second week of May.

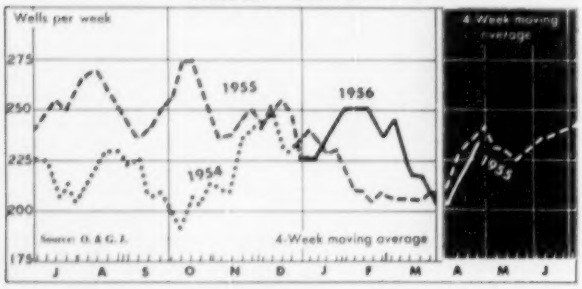
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	4-30-56	Change from 4-23-56	Change from 5-2-55
Gulf Coast	634	—12	71
N. and W. Texas-New Mexico	917	—10	39
Arkansas-N. Louisiana-E. Texas	177	2	17
Oklahoma	295	—14	—62
Kansas-S. Nebraska	188	8	—6
Illinois-Eastern	108	—4	—35
Rocky Mountain	217	6	8
Pacific Coast	135		—17
Total United States	2,671	—24	15
Western Canada	96	1	11

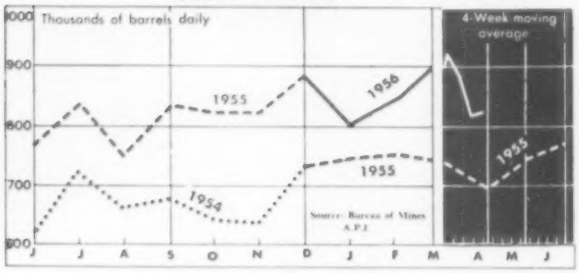
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED APRIL 28, 1956

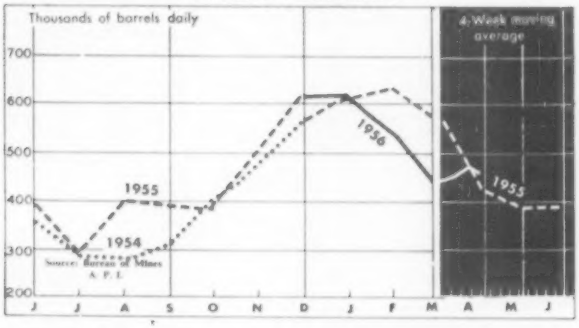
	Total of all wells: Comp.	Oil	Gas	Dry	Footage	Cum. 1956	Cum. 1955	Wildcat completions and discoveries: Oil	Dist.	Gas	Dry	Total	Cumulative total, 1956: Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	0	0	0	0	0	32	35	0	0	0	0	0	0	0	1	17	18
Arkansas	16	7	1	8	65,939	245	219	1	0	0	2	3	12	0	2	38	52
California	52	34	1	17	232,702	696	842	0	0	0	12	12	14	0	0	142	156
Colorado	18	7	1	10	88,273	361	430	0	0	0	7	7	6	0	6	165	177
Illinois	97	51	1	45	233,912	1,094	1,147	0	0	0	17	17	17	0	0	177	194
Indiana	8	3	0	5	16,439	192	245	1	0	0	2	3	6	0	1	39	46
Kansas	114	51	9	54	392,702	1,624	1,636	4	0	0	23	27	39	1	10	280	330
Kentucky	33	12	2	19	56,477	527	396	0	0	0	7	7	9	0	0	118	127
Louisiana	47	29	2	16	324,097	1,227	1,223	2	3	0	7	12	36	26	11	160	233
North	24	14	2	8	102,268	466	632	0	1	0	5	6	9	1	1	58	69
South	19	12	0	7	186,454	608	591	1	2	0	2	5	24	23	5	90	142
Offshore	4	3	0	1	35,375	153		1	0	0	0	1	3	2	5	12	22
Michigan	6	2	0	4	19,856	152	166	0	0	0	4	4	3	0	0	50	53
Mississippi	12	6	0	6	100,982	140	152	0	0	0	6	6	4	0	1	56	61
Montana	2	1	0	1	12,760	103	98	0	0	0	1	1	5	0	0	26	31
Nebraska	24	5	0	19	140,107	307	202	1	0	0	9	10	14	0	0	147	161
New Mexico	39	21	12	6	200,510	583	429	3	0	0	2	5	15	0	5	46	66
Northwest	12	0	10	2	60,252	208	109	0	0	0	1	1	1	0	5	14	20
Southeast	27	21	2	4	140,258	375	320	3	0	0	1	4	14	0	0	32	46
North Dakota	5	4	0	1	38,709	73	69	0	0	0	1	1	5	0	0	15	20
Ohio	29	15	6	*8	76,903	346	340	0	0	0	0	0	0	0	1	3	4
Oklahoma	179	103	8	†68	626,538	2,851	2,805	0	1	1	15	17	43	11	10	236	300
Pennsylvania-New York	61	30	1	30	90,792	303	490	0	0	0	0	0	0	0	1	2	3
Texas	367	224	11	132	1,634,648	6,994	6,351	17	0	4	86	107	268	20	59	1,509	1,856
Southwest (1 & 4)	58	37	5	16	238,953	1,034	1,018	1	0	2	12	15	52	5	21	296	374
Gulf Coast (2 & 3)	47	31	2	14	303,260	884	847	2	0	1	9	12	23	8	22	229	282
East (5 & 6)	18	11	2	5	94,936	355	319	0	0	0	3	3	4	1	4	128	137
North Central (7-B & 9)	123	54	0	69	404,946	2,462	2,215	8	0	0	40	48	120	0	2	583	705
West (7-C & 8)	111	83	0	28	557,256	1,889	1,628	6	0	0	22	28	68	0	6	252	326
Panhandle (10)	10	8	2	0	35,297	370	324	0	0	1	0	1	1	6	4	21	32
Utah	2	1	1	0	10,602	27	21	0	0	1	0	1	1	0	1	17	19
West Virginia	16	1	10	5	42,105	226	193	0	0	0	1	1	0	0	2	4	6
Wyoming	15	14	0	1	65,754	236	257	0	0	0	0	0	5	0	4	64	73
Miscellaneous	1	0	0	1	4,017	51	15	0	0	0	1	1	4	0	0	38	42
Total United States	**1,143**	621	66	456	4,474,824	18,390	17,761	29	4	6	203	**242**	506	58	115	3,349	4,028
Total previous week	1,141	625	80	436	4,682,845			27	4	7	209	247	477	54	109	3,146	3,786
Total April 30, 1955	1,085	587	71	427	4,295,490			29	9	5	196	239	502	77	117	3,048	3,744
Cumulative 1956	18,390	10,189	1,199	7,002	75,656,769												
Western Canada	15	8	1	6	77,775	787											

Service wells included: *2, †9.

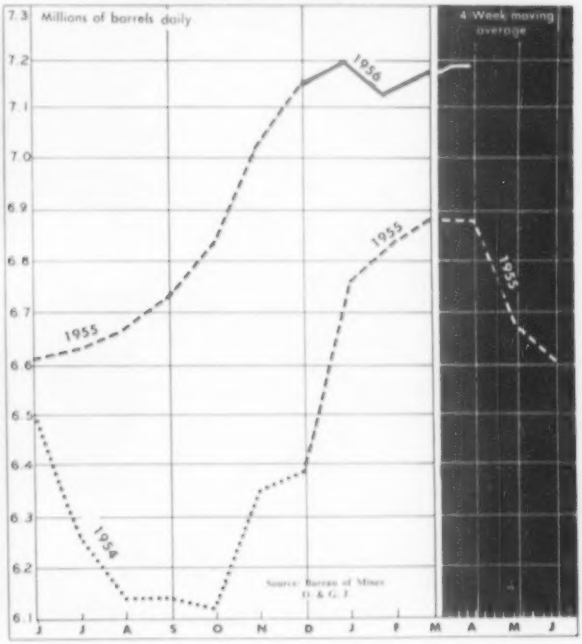
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

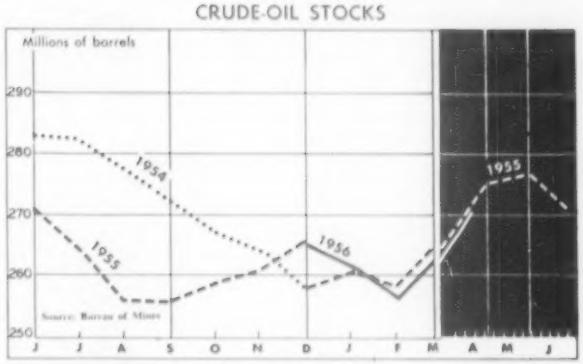


DAILY AVERAGE PRODUCTION FOR WEEK

	April 28			April 21
	Crude oil	Lease condensate	Total	total
Alabama	4,800		4,800	4,700
Arkansas	72,500	550	73,050	76,900
California	965,200		965,200	965,800
Colorado	167,400		167,400	162,800
Eastern	48,000		48,000	48,100
Florida	1,325		1,325	1,325
Illinois	226,800		226,800	227,300
Indiana	32,000		32,000	32,200
Kansas	332,200		332,200	336,900
Kentucky	48,400		48,400	46,700
Louisiana	760,400	69,400	829,800	826,900
North	120,400	2,400	122,800	119,900
South	640,000	67,000	707,000	707,000
Michigan	27,100		27,100	29,600
Mississippi	107,400	4,400	111,800	111,800
Montana	52,500		52,500	54,600
Nebraska	37,400		37,400	39,100
New Mexico	249,050	4,250	253,300	253,300
North Dakota	31,900		31,900	37,100
Oklahoma	596,900		596,900	594,600
Texas	2,982,200	52,825	3,035,025	3,035,025
Dist. 1	54,500	450	54,950	54,950
Dist. 2	151,000	8,500	159,500	159,500
Dist. 3	429,000	25,500	454,500	454,500
Dist. 4	244,000	5,000	249,000	249,000
Dist. 5	45,000	475	45,475	45,475
Dist. 6	125,700	5,900	131,600	131,600
East Texas field	215,000		215,000	215,000
Dist. 7-B	161,000	50	161,050	161,050
Dist. 7-C	189,000	4,400	193,400	193,400
Dist. 8	1,060,000	1,875	1,061,875	1,061,875
Dist. 9	213,000	500	213,500	213,500
Dist. 10	95,000	175	95,175	95,175
Utah	5,100		5,100	4,900
Wyoming	282,300		282,300	287,300
Others	‡300		‡200	200
Total U. S.	7,031,175	131,425	**7,162,600**	7,177,150
Change from previous week, down			**14,550**	
Canada	†416,200		†416,200	411,600
Total U. S. production January 1-April 28				847,465,430 bbl.
Same period last year (crude plus cond.)				*807,117,260 bbl.

*Includes 13,611,350 bbl. condensate. †Week ended previous Monday. ‡Nevada 200, S. D. 100.

CRUDE-OIL STOCKS



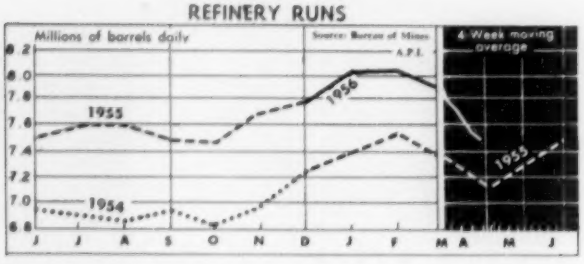
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

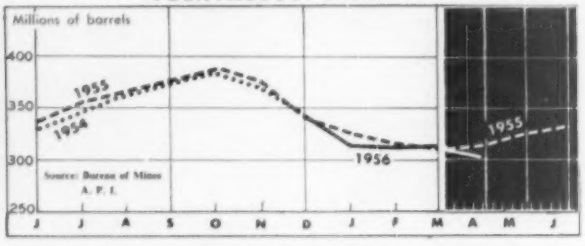
	4-21-56	4-14-56	4-23-55
Pennsylvania Grade	2,644	2,678	2,874
Other Appalachian	2,378	2,364	2,124
Illinois, Indiana, Michigan	10,006	10,083	11,069
Nebraska, North Dakota	2,050	2,016	2,525
Kansas	8,374	8,093	8,575
Oklahoma	24,860	24,159	25,402
Arkansas	2,689	2,904	3,050
Louisiana	17,431	16,827	15,526
North	2,557	2,619	2,522
South	14,874	14,208	13,004
Mississippi	3,032	2,998	2,894
New Mexico	8,050	8,284	8,717
Texas	126,202	125,289	125,747
East Texas proper	8,964	8,656	10,140
West Texas	63,526	62,431	55,691
Texas Gulf	21,880	22,102	25,325
Other Texas	31,832	32,100	34,591
Wyoming	16,511	16,108	15,074
Other Rocky Mountain	6,056	5,858	5,608
California	28,200	27,821	32,453
Foreign	†12,225	11,603	11,143
Total	270,708	267,085	272,781

*Bureau of Mines. †Includes 2,127,000 bbl. in California.

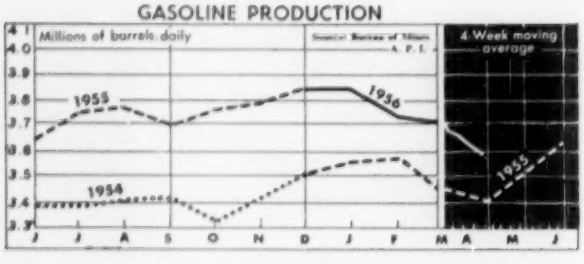
REFINERY RUNS



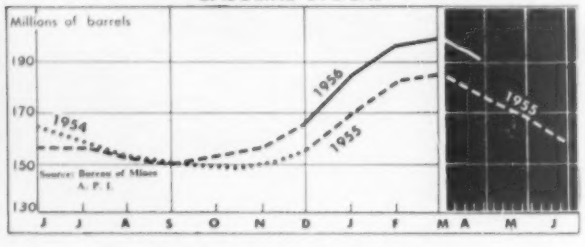
FOUR-PRODUCT STOCKS



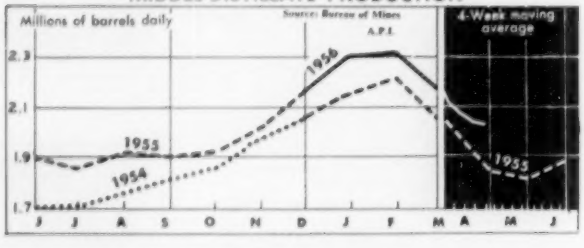
GASOLINE PRODUCTION



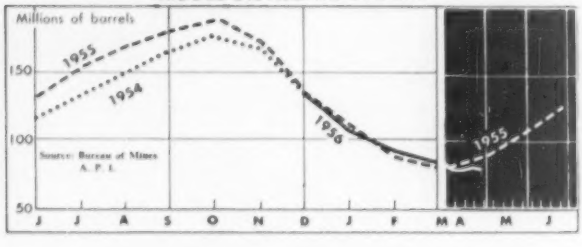
GASOLINE STOCKS



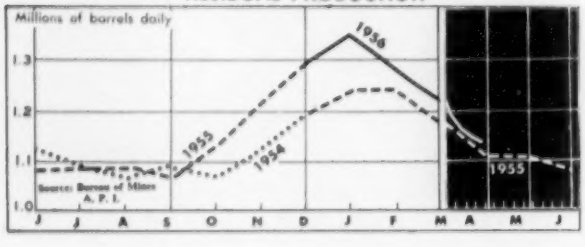
MIDDLE-DISTILLATE PRODUCTION



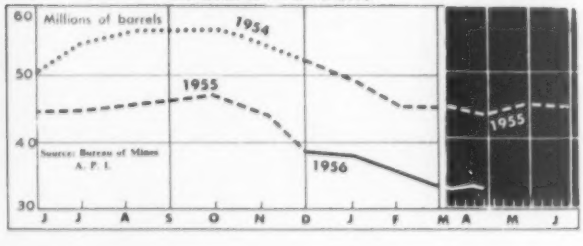
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, APRIL 27

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, April 1955—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	991	425.3	33.3	276.6	193.1	39,569	7,019	17,129	7,361	996	398.9	26.5	248.7	203.6
Appalachian:														
District 1	111	41.1	5.0	24.9	5.3	4,691	398	1,219	264	100	41.2	3.9	23.9	7.6
District 2	112	49.6	6.7	12.1	10.9	3,125	418	530	223	82	44.7	4.9	13.9	13.2
Ind., Ill., Ky.	1,376	669.1	81.3	276.6	178.3	40,259	3,330	10,365	3,720	1,262	650.3	66.1	240.8	155.3
Okla., Kans., Mo.	632	341.3	13.9	159.1	26.7	20,896	813	6,929	1,095	591	317.2	16.4	136.5	35.9
Inland Texas	244	187.6	7.1	49.3	24.0	6,863	332	1,360	1,360	259	192.2	11.0	46.0	19.2
Texas Gulf Coast	1,941	939.7	103.3	504.3	256.6	26,589	2,504	8,928	5,277	1,793	819.4	112.3	412.6	238.0
La. Gulf Coast	663	331.8	55.7	152.3	51.3	10,338	2,172	4,066	1,488	643	337.0	53.3	160.7	34.7
N. La. and Ark.	60	24.3	4.1	15.1	3.7	4,517	321	1,180	41	86	31.0	7.9	21.7	6.1
Rocky Mountain:														
New Mexico	22	11.6	.....	4.0	2.9	332	4	89	38	21	11.0	0.3	3.5	2.8
Other Rocky Mtn.	256	110.0	2.9	56.3	36.4	7,941	237	2,048	886	226	94.0	3.8	57.7	31.5
California	1,039	426.3	1.7	164.7	333.4	25,068	346	8,080	10,723	1,077	472.4	6.0	168.5	361.7
Apr. 27, 1956	7,447	3,557.7	315.0	1,695.3	1,122.6	190,188	17,894	61,923	32,476	7,136	3,409.3	312.4	1,534.5	1,109.6
Apr. 20, 1956	7,436	3,514.1	292.0	1,711.7	1,168.9	192,933	§17,867	61,926	32,829					
Apr. 29, 1955	7,159	3,442.7	303.7	1,503.0	1,113.7	176,759	21,012	67,635	43,887					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines. §Revised.

Crude-oil and refinery prices at representative U. S. and foreign points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (86 octane)	11.25-11.50
Premium (94 octane)	12.75-13.00
Gulf Coast (cargoes for coastwise or export movement):	
Regular (90 octane)	11.25-11.50
Premium (97 octane)	13.00-13.25
New York (barges):	
Regular (89 octane)	12.25
Premium (96 octane)	14.50
California—Los Angeles (rack):	
Regular (84 octane)	12.9-13.15
Premium (93 octane)	14.0-14.25
Caribbean area (cargoes):	
Regular (87 octane)	10.50
★ Premium (93 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	10.00-10.25
Diesel oil (58 d.i. and above)	9.625-9.875
Distillate No. 1	9.625-9.875
Distillate No. 2	9.00-9.25
Gulf Coast (cargoes):	
Kerosine 41-43	9.5
Distillate No. 2	8.75-9.25
New York Harbor (barges):	
Kerosine 41-43	10.85
Distillate No. 2	10.35
Diesel fuel, 48-52 d.i.	10.65
Caribbean area (cargoes):	
Distillate No. 2	8.75

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude scale (solid in bags or barrels)	7.35

★ Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$2.00-2.10
Gulf Coast (cargoes):	
Bunker C fuel	$2.10
New York Harbor (barges):	
Bunker C fuel	$2.65
Caribbean (cargoes):	
Bunker C at Aruba, N.W.I.	$2.10
California (rack):	
Bunker C fuel, Los Angeles	$2.10-2.20

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	24
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.75
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	24
200 vis. neutral (180 at 100°), 25 p.t.	21

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.02				
15-15.9	2.08				
16.16.9	2.13				
17-17.9	2.19				
18-18.9	2.24				
19-19.9	2.30				
20-20.9	2.35	$2.50		$2.37	
21-21.9	2.41	2.52		2.39	
22-22.9	2.47	2.54		2.41	
23-23.9	2.52	2.56		2.43	
24-24.9	2.58	2.58	$2.91	2.45	
25-25.9	2.64	2.60	2.93	2.47	
26-26.9	2.69	2.62	2.95	2.49	
27-27.9	2.76	2.64	2.97	2.51	
28-28.9	2.83	2.66	2.99	2.53	
29-29.9	2.91	2.68	3.01	2.55	
30-30.9	2.97	2.70	3.03	2.57	
31-31.9	3.04	2.72	3.05	2.59	$2.46
32-32.9	3.12	2.74	3.07	2.61	2.48
33-33.9	3.20	2.76	3.09	2.63	2.50
34-34.9	3.27	2.78	3.11	2.65	2.52
35-35.9	3.34	2.80	3.13	2.67	2.54
36-36.9	3.39	2.82	3.15	2.69	2.56
37-37.9		2.84	3.17	2.71	2.58
38-38.9		2.86	3.19	2.73	2.60
39-39.9		2.88	3.21	2.75	2.62
40 and up		2.90	3.23	2.77	2.64

*Includes Oklahoma, Kansas, North Dakota, West Texas (sweet), North Central Texas, North Louisiana, Arkansas, and Wyoming (sweet). †Low-cold-test Gulf Coast. ‡Sour.

Effective dates: California, February 7, 1956; east of California, June 15, 1953; Pennsylvania Grade, March 16, 1956.

FLAT PRICES

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	4.20
Middle District	4.07
Southwest Pennsylvania	3.78
West Virginia	3.66
Buckeye Grade	3.60
Zanesville Grade	3.02
Illinois Basin	3.00
Canada:	
Leduc-Woodbend (flat prices D-2, D-3)	2.60
Redwater (Alta.) D-3	2.49
Smiley-Viking (Sask.)	2.26
Fosterton (Sask.)	1.29
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-48.9°, Tucupido	*3.40
San Joaquin, 41°-41.9°, Puerto La Cruz	*3.04
Oficina, 35°-35.9°, Puerto La Cruz	*2.80
Tia Juana medium, 26.5°-26.9°, Amuay	‡2.30
Quiriquire, 16.5°-16.9°, Caripito	‡2.21
Lagunillas heavy, flat, Amuay or Las Piedras§	2.05
Bachaquero, 16.5°-16.9°, Amuay or Las Piedras§	‡1.90

*Plus or minus 2 cents per barrel for each degree gravity change. †Plus or minus 2.5 cents per barrel for each half-degree gravity change. ‡Plus or minus 3.5 cents per barrel for each half-degree gravity change. §Also available at La Salina at 3.0 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$1.97
Iranian, 34.0°-34.9°, Bandar Mashur	1.91
Iranian, 34.0-34.9°, Abadan	1.86
Iraq, 36.0-36.9°, Fao	1.87
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.46
Iraq, 36.0°-36.9°, Tripoli, Banias	2.46
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

TANKER RATES (PER LONG TON)

(Latest reported spot fixtures)

NWE-USNH, dirty (USMC+100%)	$5.40
★ Gulf-USNH, dirty (USMC+100%)	5.70
★ P.G.-France, dirty (USMC+15%)	12.54
★ P.G.-U.K., dirty (USMC+22.5%)	13.35

Your MARKET PLACE FOR THE OIL AND GAS INDUSTRY

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FOR SALE EQUIPMENT

FAILING 1500 H.D. drill with 4½ x 5 pump, automatic pulldown, mounted on 1951 Ford. Also, Griffin water tank, mounted on 1951 Ford. Write P. O. Box 819, Longmont, Colo., Phone 1333.

SALES AND RENTALS. Used cable drilling and fishing tools, casing, production equipment; from the Southwest's largest stock of oil field supplies. Degen Pipe and Supply Co., Tulsa.

COMPLETE CHARCOAL ABSORPTION natural gasoline plant, 20 MMCF capacity with additional purification equipment consisting in part of the following main items: 3 80 hp. boilers; 1 Girbotol purifying tower; Perco treating tower; 3 horizontal activated carbon absorber tanks; 6'6" diameter by 16'6" long, 1" plate; 8 vertical iron-oxide purifier tanks, 4'6" diameter by 13' long, 1" plate; 8 8,000 gal. storage tanks; 1 tank truck loading rack; 1 elevated 8,000 gal. loading-rack supply tank. 4 steel buildings to house above equipment. Plant may be inspected while in operation. Location Cleveland, Ohio. If interested call or write F. C. Durst, Purchasing Agent, The East Ohio Gas Company, 1405 East 6th Street, Cleveland 14, Ohio, Telephone SUperior 1-8100.

PIPE FOR SALE — New — Unused. All seamless grade B, API 5LX, Coated and Wrapped. 200 Feet 12¾" 330 Wall, $4.64 foot. 3200 Feet 8⅝" 277 Wall, $2.14 foot. 1670 Feet 8⅝" 280 Wall, $1.67 foot. 360 Feet 4½" 237 Wall, $1.01 foot. Price includes coating and wrapping, loaded on trucks FOB Montgomery, M. R. Thomason, R.F.D. 6, Box 21, Montgomery, Alabama.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units, Westinghouse 20-25-50 KW Generating Units

H. H. COFFIELD
Attn.: W. H. ORR
Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

FOR SALE—VERY LARGE LOT OF NEVER USED, FIRST GRADE

Surplus Oil Drilling Equipment

consisting especially of Rock and Drag Bits (Reed, Hughes), Liner Hangers, Cementing equipment, slotted pipe casings API, threading and cutting machines, etc.

UNUSUAL OPPORTUNITY

Give your particulars and write for detailed list to

Bishop International Corp.
1123 BROADWAY
NEW YORK 10, N. Y.

PIPE 1/8" thru 30"

"FASTER from FOSTER"

TESTED & STRUCTURAL
Large Warehouse Stocks

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CORE DRILLS, SPUDDERS, ROTARIES. New and used equipment. Everything in supplies. Fishing tools rented. Pressey & Son, Pueblo, Colo.

FOR SALE—At Tallant, Oklahoma, three 5'x56' absorbers, 20 trays, 24" spacing 500# WP, peak design each 40,000 MCFD at 350 PSIG; oil rate 100-300 GPM, min. and max. Bought new 1947, taken out of service 1954. Price $8500.00 each, now standing. Full data upon request. Cities Service Oil, Patridge, Bartlesville, Oklahoma.

FOR SALE—Used: 100 Joints, approximately 3,100 feet of 4½" OD Grade "D" Drill Pipe with 5¾" to 6" OD Tool Joints with 4½" FH Threads. This pipe is located in Oklahoma City, priced at $1.50 per foot. Call FALCON SEABOARD DRILLING COMPANY at MElrose 7-2441 in Oklahoma City, or LUther 7-6502 in Tulsa.

FOR SALE—At Oil Hill, Kansas: 4—Cooper type 80 twin engine compressor units, with 8½"x20" class A and 15½"x20" class C compressor cylinders. Also, 1—type 80 single DO, with 6½" and 10½" x 20" tandem compressor cylinders. All with 18" x 20" power cylinders. Cities Service Oil, Patridge, Bartlesville, Oklahoma.

STEEL PIPE & TUBING

- CHROME MOLY
- CARBON MOLY
- MONEL
- CARBON STEEL
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Widest Range of Sizes & Specs in the U. S.

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MIDCONTINENT TUBE SERVICE, INC.
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FOR SALE

Two 55,000 bbl. Steel Storage Tanks, Steel Cone Roofs. Located at Washington, Kansas.

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1—800# 20 MMCF Absorber with Scrubber, etc.

1—Fluor "Counterflo" Induced Draft Cooling Tower Complete.

Vessels, Generators, Pumps, Instruments, Pipe, Valves, and Fittings and Other Equipment necessary in Gasoline Plant Construction. Detailed Inventory Available upon request.

Southern Production Company, Inc.
P. O. Box 670 Phone—EDison 2-6101
FORT WORTH, TEXAS

SAVE MONEY
on
8" LINE PIPE
LAPWELD 8⅝" O.D. 28.55

Very good No. 1 grade, used pipe. Straight 20' single random lengths machine cleaned.

Choice of plain end or T&C. Ideal for oil, water and gas systems, 850 to 900 psi. Pipe located in Illinois, with low barge, rail and water rates to any part of the world. Priced below market, selling at almost ⅓ cost of equivalent new pipe. Will sell for cash or will finance meritorious propositions.

Brokers and agents protected.

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BRILL LIQUIDATION!

FORMER LACY REFINERY
BIG SANDY, TEXAS

COMPLETE POLY UNIT, BUILT 1958
UOP RATED 144 BBL./DAY

Complete Perco unit built 1950. Phillips Petroleum rated 1400 bbl./day.
1—Wyatt 30" x 70' Stabilizer 160# 30 tray
20—Brown fintube exchangers, 600# 140 sq. ft. 4-6 chrome.
20—Brown fintube exchangers, 600# 11, 21, 77, 101, 140 sq. ft.
5—Adm. Heat Exchangers, 644, 424, 348, 176 sq. ft.
2—Perco reactors 4500 gal., 8' x 12', 347 stls. st. 120#, 1000° F.
1—5' x 96' tower, 40 tray, 135# WP.
1—7' x 30' Propane tank, 250# WP.
1—10' x 50' Crude tower, 18 trays.
1—6' x 34' Vacuum tower, 150#.
1—2' x 50' tower, 24 trays.
3—Welded tanks, 10' x 40', 10' x 30', 5' x 20'.
3—St. Exchs., 920, 850, 480 sq. ft.
9—Oilfield boilers, 125 hp., 275#.
1—Ethyl lead plant.
3—Penn. comp. 8 x 11 x 9, 12 x 11½ x 13, 10 x 6 x 11.
2—Convection furnaces, 20 MIL BTU/hr.
1—Vapor phase cracking furnace.
12—Welded storage tanks, 5000, 2000, 100, 500 Bbl.
8—Hi-vol pumps, 10 x 7 x 18, 10 x 6 x 12, 6 x 4 x 12, 6 x 3 x 8.
30—Duplex piston pumps, all sizes.
1—10' x 30' asphalt still.
6—Steel Bldgs., 20 x 150, 12 x 20, 20 x 40, 20 x 20.
8—GR Fin Tube Exchangers, 101 sq. ft.
1—BS&B Oil & gas separator, 10.7 mcf, 3500 Bbl./day.
Large Selection of Series 15, 30 Steel Valves, 1" to 8".
Approximately 15,000 ft. Schedule 40, 80 pipe, 2" to 8".

EQUIPMENT ELSEWHERE

COMPRESSORS AND PUMPS

2—Worth. LTC-6 830 hp Comps.
3—Clark RA-8 800 hp. Comps.
1—Worth. LTC-3 400 hp. Comp.
1—IR XVG-8 300 hp. Comp.
B-J hot oil pump 3 x 9, 13 st, 325 gpm, 4620' hd.
Gould 16" pump 10,500 gpm, 135' hd.

COLUMNS

7'6" x 55' 30 trays 45 lb
8' x 75' 25 tray 40#
2' x 60' 35 tray 560#
5'6" x 59' 30 tray 200#
2' x 42' 30 tray 250#
13" x 35' 30 tray 500#

HEAT EXCHANGERS AND STILLS

6—Adm. 785, 742, 425 sq. ft.
3—St. 2000, 785 sq. ft.
30—Atmospheric Bentube exch., stls and Adm. 715, 470 sq. ft.
30—304 SS shell & tube condensers 100-1000 sq. ft.
Lab Petro-chem furnace 50,000 BTU/hr.

TANKS & VESSELS

3—10' x 40' hor. wld. tanks
2—8½' x 25' hor tanks 50# WP.
1—10' x 30' hor welded tank

MISCELLANEOUS

800 ft. of 2" 4-6 ch pipe
Large quantity of 410 SS chrome strips and sheets.
Tremendous selection stainless steel and steel valves ½"-6".

Partial List Only

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Or
2401 Third Ave., New York 51, N. Y., CYpress 2-5785

FOR SALE EQUIPMENT

U-15 DRILLING RIG located in Beaver County, 3 NKU Waukesha Motors, Hydraulic Floor Operated Blowout Preventor, 131' Lee C. Moore Mast, steel mud pits, 7⅞ x 16 Gardner-Denver pump, 8000' 4½" Drill Pipe recomplete. Call CEntral 2-6318, Oklahoma City, Oklahoma.

FOR SALE: 86' Oilwell Mast, with 4⅛ Substructure. Telephone: CE 2-6318, Oklahoma City, Okla.

FOR SALE: Oil field trucking business with equipment and permits for Texas and Oklahoma. Grosses $65,000 per year. Located in Wichita Falls, Texas. Address inquiries to Box J-490, The Oil and Gas Journal, Tulsa, Oklahoma.

ALMOST NEW 3000 feet portable rotary complete, trucks, floats, etc., HO 5-3965, 22 Carolane Trail, Houston.

200,000' 2⅜" OD new electric weld upset tubing range 2.8 round thread, hydrostatically tested 3000# PSI. Guaranteed to give same service as seamless tubing 30-60 day delivery. Box J-497, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: Wilson-Snyder mud pump, 7½" x 18". Top condition and less than half price. L. T. Peyton Machine Shop, Vernal, Utah. Phone 267.

EMSCO 250 RIG, complete with Emsco double mast. Excellent condition. 4,000-ft. practically new, 4½-in. drill pipe. Rig now running. Bargain. Phone FOrest 8-5886, 421 Meadows Bldg., Dallas, Tex.

MODEL S-32 Special Walker-Neer Spudder, complete with standard equipment, including 8⅝" x 7" x 60' telescoping poles, Model No. 140 GKU-Waukesha Engine, Model 8041 Brown Line Transmission, mounted on Tandem Float, purchased new November, 1955. Equipped with complete tools, Dog House, 49 GMC, FC 452 truck and oilfield platform BC True Trailer, $35,000.00. The Theiss Drilling Company, 740 West Fifth Street, Fort Worth, Texas.

WANT EQUIPMENT: Did you find the equipment you wish to purchase in this column? If not, use an "Equipment Wanted" classified advertisement to find it. It is available somewhere and Journal classified advertisements will find it. See box heading for classified rates, or write The Oil and Gas Journal.
Journal.

FOR SALE: National 50 Drilling Rig Complete, for details, call or write Ralph W. Shebester, Box 337, Pauls Valley, Oklahoma. Telephone 570.

FOR SALE—2 truck mounted Bettis steam units. Good condition, equipped for oil field work. Box J-332, The Oil and Gas Journal, Tulsa, Oklahoma.

RECORDING INSTRUMENTS, fair condition, mounted on good truck. Dual power reels and cables. Bargain. Box J-460, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE—Used: 4,200 Feet of 4" OD Bottleneck Grade "D" Drill Pipe with 5½" to 5¾" OD Tool Joints with H-90 Threads. This pipe is located in Oklahoma City, priced at $1.75 per foot. Call FALCON SEABOARD DRILLING COMPANY at MElrose 7-2441 in Oklahoma City, or LUther 7-6592 in Tulsa.

GARDNER-DENVER 2-stage gas compressor, less engine, completely unitized with coolers, scrubbers and engine skid. Completely overhauled by Gardner-Denver. Perfect condition guaranteed. Gulf Southwest Service Co., P. O. Box 1328, Shreveport, La.

FOR SALE: Slightly used Model 118 Royal Scintillator, $1250.00. Write L. E. Farley, Inc. P. O. Box 6841, Houston 5, Texas. Or phone Earl Tise, JAckson 2-3791.

5—KOBE TRIPLEX pumps, size #3, complete w/engines consisting of: 2—LeRoi H-540 V8 motors. 3—Buda 6MO672 motors. 1—Parkersburg steel building, 24' x 24'. 2—Parkersburg steel building, 12' x 24'. 1—Parkersburg steel building, 20' x 24'. 25—Kobe units complete w/all accessories. Approx. 115,000' of 1" Kobe tubing. This material all in good condition. Complete inventory upon request. Phone AM 6-9636, Garfield and Pasternak, 1402 Mile High Center, Denver, Colorado.

GAS COMPRESSORS: Two 300 H.P. Gardner-Denver RXE Horiz. two-stage unitized on skids with LeRoi L-3000 oil field power units. Like new. McNamar Boiler & Tank Co., Tulsa, Box 868, phone CHerry 2-6261.

EQUIPMENT WANTED

USED 315 cubic foot portable air compressor with or without engine. Green Machinery Co., Inc., 1201 East 5th St., Plainview, Texas.

WANTED: Joy or Fuller Compressors. Give description and price. P. O. Box 1732, Tulsa, Okla.

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For sub-lease. Partially equipped, including complete dark room, approximately 4000 sq. ft., air-conditioned. Private parking lot adjoining. 2507 North Blvd. near Kirby Drive.

Gulf Research & Development Company
Attn.: J. N. Henderson
P. O. Drawer 2100 Houston 1, Texas

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WANT REPRESENTATIVE in South America for specialized line of oilfield production equipment. Commissions are far above average. Send resume giving sales outlets and sales force. Box J-491, The Oil and Gas Journal, Tulsa, Oklahoma.

Engineering Services Available

We are in a position to do full time or part time engineering studies and consultations on drilling, producing, and equipment problems for companies active in drilling and producing.

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PETROLEUM ENGINEERS

Graduate Petroleum Engineers with 2 - 6 years' experience wanted by Major Oil Company for work in Mid-Continent and Gulf Coast areas. Openings available for Reservoir and Field Production Engineers. In first reply give resumé of experience, date available, and salary expected.

BOX J-479, THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

SALES REPRESENTATIVES WANTED:

Manufacturer of Oil-Gas Separating, Treating, Metering, and Automatic Lease Equipment wants commission Sales Representatives for (1) East Texas, Southern Arkansas, Northern Louisiana, (2) Texas Panhandle, (3) Williston Basin, (4) Illinois, Indiana, Kentucky, (5) Canada, (6) Mexico. Protected Territories available on exclusive Contract Basis to qualified and experienced men. Please give details concerning Sales Coverage, lines handled, and sales experience in first reply.

BOX J-507,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

SIX CAREER OPPORTUNITIES
With
Responsibility and Challenge

The Parkersburg Rig & Reel Company, manufacturers of oil and gas equipment, have six long-range positions immediately available for qualified engineers.

CHEMICAL ENGINEERS (2) You will work with a small development-team of engineers. Your job will be the improvement of existing apparatus and the design and development of new equipment. As we see it, you are ideally suited for this work if you have 3 to 10 years, or more, oil-country experience as a gas engineer or process engineer. Your desire to tackle problems of adsorption, heater design, and vapor-liquid separation will count heavily.

MECHANICAL ENGINEERS (2) Here, too, you will work as a member of a small, fast moving development group on the improvement of present apparatus and the design and development of new products. You should have 1 to 5 years oil-country experience in pressure-vessel design, piping systems, or the mechanical aspects of oil production equipment.

APPLICATION ENGINEERS (2) This work is a part of a product-service group within an engineering department. You should have a keen interest in applying apparatus to the needs of the lease operator. You will be a link between the salesman and the engineering group. Technical writing is a part of the work. For this job, we believe you should have from 2 to 10 years, or more experience with oil-country equipment. Some of this time might well have been in sales-work.

If these openings interest you, please send us a resume of your experience. We will reply promptly and your application will be held in confidence. Salaries for these positions are open and will depend upon your experience and ability.

Address your reply to

The Parkersburg Rig & Reel Company,
Box 13295, Houston 19, Texas

HELP WANTED

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For drilling production and equipment on varied types active fields.

EXCELLENT SALARY, ALLOWANCES, OPPORTUNITY OBTAIN ADDITIONAL EXPERIENCE & ADVANCEMENT.

Positions Available Venezuela & Colombia. Graduate Engineers—minimum 2 years exp.

Forward Personal data, college transcript, to:

C. L. LAUE

SOCONY MOBIL
OIL CO., INC.

26 Broadway, New York 4, New York

PETROLEUM ENGINEERS

Active independent oil company has vacancies for graduate petroleum engineers with two to five years of practical experience in drilling and production in West, West Central or North Texas. Excellent opportunities for growth and advancement. Replies should furnish complete personal data, education, experience, and starting salary desired.

BOX J-508,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

PETROLEUM ENGINEER

Independent drilling and production company operating in Mid-Continent area has opening for young graduate petroleum engineer specializing in drilling techniques and machinery. Must have field experience. Will work closely to manager of operations. Good personality essential. Age limit under 35. Give past employment record and educational background in reply. Reply

Box J-515,
The Oil and Gas Journal,
Tulsa, Oklahoma.

REFINERY OPERATORS

With minimum 7 years' oil refining experience. Must have experience on process units, such as crude distillation, thermal reforming, fluid catalytic cracking and reforming and thermal cracking. For refinery operation in Saudi Arabia.

Write outlining personal history and work experience.

Recruiting Supervisor, Box 136

ARABIAN AMERICAN OIL COMPANY
505 PARK AVENUE
NEW YORK 22, N. Y.

HELP WANTED

CHEMIST, Ph.D. Under 35. Interested in organic research. Recent graduates considered. With major oil company in Tulsa. State qualifications and salary expected. Write Employee Relations Department, Post Office Box 381, Tulsa 2, Oklahoma.

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for engineer with sales inclinations to get in on ground floor of air drilling of oil and gas wells. Old, established compressor manufacturer, already recognized for pioneering in air drilling, needs man to head up sales and engineering program.

REQUIREMENTS:

1—Enthusiastically believe in future of air drilling.
2—Petroleum or mechanical engineer that knows drilling procedures.
3—Preferably, known in trade, although not necessary.
4—Must be interested in traveling, although home base might well be in Middlewest or Southwest with only occasional visits to Plant and Engineering Department in East.

Interviews will be arranged from written applications mailed to

Box J-508,
The Oil and Gas Journal,
Tulsa, Oklahoma.

Petroleum chemist

BEEN LOOKING for a position with lots of day-to-day variety and interest? The petroleum instrumentation section of the Fisher Development Laboratories is the place. Your assignment: to design and promote new items in a leading line of petroleum testing equipment and handle liaison with the ASTM.

Age: 30-40 . . . petroleum lab experience . . . familiarity with ASTM methods and apparatus . . . a flair for instrument design. Employee benefits are excellent; working conditions A-1.

Rush résumé (confidential), salary requirements, instrumentation background, to PAUL FAUPEL, PERSONNEL MGR., FISHER SCIENTIFIC, 711 FORBES ST., PITTSBURGH 19, PENNA.

HELP WANTED

PETROLEUM ENGINEER. Active independent Oil Company has vacancy for graduate petroleum engineer for work in the Gulf Coast area. Experience in drilling and production desirable but not mandatory. In first reply give resume of education and experience and salary desired. All replies will be held in strict confidence. Box J-505, The Oil and Gas Journal, Tulsa, Oklahoma.

We have the following openings in our growing Engineering and Maintenance organization, with excellent long range opportunities for qualified men:

DESIGN ENGINEER
Machinery and equipment design.

INSPECTION ENGINEER
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DRAFTSMAN
Piping and/or structural
Above with 3 to 7 years' experience in Refinery or Process Chemical Plant.

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Prefer B.S.M.E. with some metallurgical training, experience or interest.

Please send resume and salary requirement to Industrial Relations Department Head

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Division of W. R. Grace & Co.
P. O. Box 4906,
MEMPHIS, TENN.

FOREIGN EMPLOYMENT

The Arabian American Oil Company has immediate job openings for unmarried males with minimum 5 years' experience in the following classifications:

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High pressure boiler experience.

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Heavy industrial construction and maintenance experience.

MACHINIST
Inside and outside experience.

INSTRUMENT REPAIRMAN
Oil refinery or chemical processing experience.

CHEFS
Large scale institutional, restaurant or construction camp experience.

Write outlining personal history and work experience.

Recruiting Supervisor, Box 122

ARABIAN AMERICAN OIL COMPANY
505 PARK AVENUE
NEW YORK 22, NEW YORK

HELP WANTED

AREA ENGINEERS

Several graduate engineers with minimum 5 years' experience supervising maintenance engineering functions in oil refining or producing facilities, power plants, heavy industrial installations, manufacturing plants or related operations. To establish technical supervision, procedures, maintenance operations and schedule routine and special work for major oil producing and refining operation with all supporting facilities; i.e., housing, feeding, recreation, etc.

Salary commensurate with background and experience. Write giving full particulars regarding personal history and work experience. Please include telephone number.

Recruiting Supervisor, Box 64

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505 PARK AVENUE
NEW YORK 22, NEW YORK

HELP WANTED

PETROLEUM ACCOUNTANT

Practical accountant to handle office detail for an established independent oil producer. Knowledge of field operations, materials and where used will be helpful. Salary commensurate with experience and ability.

CRAWFORD PRODUCTION COMPANY
316 Enterprise Building, Tulsa 3, Okla.

PETROLEUM ENGINEER

Graduate with 3 to 5 years experience in reservoir and valuation of oil and gas reserves, opening with Mid-Continent Area Bank. In reply give resume of experience and salary expected.

All replies confidential.

Box J-500,
The Oil and Gas Journal,
Tulsa, Oklahoma.

NATURAL GASOLINE PLANT ENGINEER

To conduct field investigations for possible new plant locations (any size) and to supervise contract negotiations, plant design and operations for substantial independent company. Should have broad knowledge of the oil and gas producing areas and successful background of plant operations. Replies should state age, outline personal history and work experience. Replies kept strictly confidential.

BOX J-501, THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA

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3 year extendable contract employment in Baghdad, Iraq Government Oil Refineries.

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Will advise methods of most efficient operation. Chemical Engineering degree or equivalent.

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Handle layout and construction project assignments. Civil engineering degree or equivalent.

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Maintenance of all heavy duty equipment including diesels and teaching others.

Your application invited if you have recently been working in one of these jobs, have several years experience in it, and can pass a rigid physical examination.

APPLICATIONS ARE ALSO INVITED FOR OTHER JOBS THAT OCCASIONALLY ARE AVAILABLE FOR TECHNICAL AND OPERATING PERSONNEL.

Accepted applicants will be offered contracts embodying tax free liberal salary with furnished modern house including utilities, 1st class air transportation for self and family to Baghdad and return, medical care, accident insurance, and annual 30 day vacation.

Qualified applicants should send complete personal and work history, compensation received, references, and other helpful information you deem pertinent.

Apply by letter to General Refinery Manager,
P. O. Box 1445, Chicago 90, Illinois

HELP WANTED

EXPLORATION EXECUTIVE—Independent oil producing corporation operating in Mid-Continent field desires experienced man presently employed in middle or top-management exploratory capacity. Please furnish age, education, experience, references and salary required. All replies will be kept confidential. Box J-502, The Oil and Gas Journal, Tulsa, Oklahoma.

Petroleum Geologists

Established Oil Company desires geologists for employment in West Texas area. Must know area and have four to six years of active experience in subsurface mapping and interpretation. Excellent opportunity for advancement. Salary will be commensurate with ability and experience. Reply should state age, education, experience, and salary desired.

BOX J-485,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

GEOPHYSICAL POSITIONS AVAILABLE

WANTED, Party Chiefs, Seismologists, Computers, Surveyors, and Observers for domestic work in Louisiana, Texas, Oklahoma and New Mexico, and possibly some foreign work.

REQUIREMENTS: Interpretive positions must have a minimum of two (2) years college plus experience. Field positions must have minimum two (2) years experience. Observers with SIE, Electro-Tech and Century experience preferred. Mail letter of inquiry with pertinent information and references to:

SOUTHERN GEOPHYSICAL COMPANY

P. O. Box 12217, Fort Worth, Texas
Route 4, Box 646, Houston, Texas

Petroleum Engineers
(South America)

Graduate engineers with experience in drilling, production, reservoir and equipment. Working knowledge of Spanish desirable but not essential.

Lubrication Engineers
(West Africa)

Mechanical Engineer's degree and experience in lubrication and petroleum products. Fluent French not essential but working knowledge desirable.

Operations Supervisor
(West Africa)

Experienced all phases construction engineering concerning marketing petroleum products, i.e., appropriations, terminal layout and maintenance. M.E. or C.E. degree desirable but not essential. Working knowledge French essential.

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Forward resume of education and experience to

THE TEXAS COMPANY
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NEW YORK 17, N. Y.

HELP WANTED

FOREIGN EMPLOYMENT. List of oil companies and drilling contractors showing where to apply for foreign jobs. OIML Co., Box 2603, Tulsa, Okla. $5.00 cash.

OIL FIELD SERVICE ENGINEERS

Mechanical or Petroleum Engineers with some field experience. Men without degrees but with two years rotary or workover rig experience may qualify. High school diploma or equivalent required. Age under 35 preferred. Good pay with excellent fringe benefits. Automobile and expenses.

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Forward personal data, college transcripts, to:

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Experienced graduate engineers for immediate openings in Saudi Arabia and New York City. For engineering work in development, production, drilling, process, and oil and gas engineering on primary and secondary recovery problems.

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With degree in Physical Chemistry or Chemical Engineering plus 5 years' petroleum production engineering experience which should include 2 years' study of reservoir fluid behavior.

Salaries commensurate with training and experience. Write outlining personal history and work experience. Please include telephone number.

Recruiting Supervisor, Box 116

ARABIAN-AMERICAN OIL COMPANY

505 PARK AVENUE

HELP WANTED

CHEMICAL FIELD

Career opportunity for Chemist or Chemical Engineer. An individual with 3 or more years pertinent experience in petroleum refining or allied laboratory test methods with leadership to assume supervision of control laboratory. Must be thoroughly qualified to present written reports. Submit resume of personal data, education, experience and starting salary desired.

Box 109, Dept. CJ Personnel

Velsicol Chemical Corporation
MARSHALL, ILLINOIS

PETROLEUM ENGINEER

The National Iranian Oil Company has vacancy for one experienced Petroleum Engineer to advise management on drilling, production and reservoir engineering problems. Salary commensurate with background and experience. Three years contract. Write giving full details such as age, marital status, education, details of previous experience, last salary, etc., to

Embassy of Iran,
3005 Massachusetts Ave.,
Washington D. C.

SITUATIONS WANTED

PETROLEUM ENGINEER: 35 eight years Production & Engineering. Desires to relocate. Box J-493, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEER - LANDMAN - LAWYER wants job with progressive oil company or operator offering opportunity. B.S. & LL.B. degrees, age 35, 10 yrs. experience. Can do engineering or land work, supervise exploration and development or be executive assistant to management. Prefer job developing drilling deals. Box 2702, Midland, Texas.

GEOPHYSICIST—ten years interpretation and field supervision. Desire position with oil company. Box J-503, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, single, 32, 4½ years geophysical experience, desires position in permanent location. Box J-498, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE PETROLEUM ENGINEER, 33, 7 years engineering experience in drilling, completion, and production, Oklahoma and Texas with major and independent. Present location Dallas. Best references. Box J-506, The Oil and Gas Journal, Tulsa, Oklahoma.

ARE YOU INTERESTED in a Young, Aggressive man with technical and administrative abilities? Degrees in Chemical Engineering and Management. Experience in design and sales of gas processing equipment. Interested only in a good growth situation. Box J-510, The Oil and Gas Journal, Tulsa, Oklahoma.

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Well organized, well established oilwell drilling contractor desires the management and supervision of oil properties in West Texas, Central Texas, and New Mexico. Can provide complete handling of oil properties, from acquisition to production. No properties too small, and none too large to handle. Inquiries from independents, groups, small or medium sized oil companies invited.

Write, wire, or call collect for further information.

MAKIN DRILLING COMPANY

P. O. Box 1628, Hobbs, New Mexico
Phone 3-3141.
146 Allen Building, Midland, Texas
Phone 2-2902.

SITUATIONS WANTED

LANDMAN - ENGINEER, B.S., 8 years in land, engineering with Major and Independent. Desire connection with Independent on Gulf Coast. Box J-509, The Oil and Gas Journal, Tulsa, Oklahoma.

PIPELINE ENGINEER: Registered, 33, 8 years diversified experience in design, construction and operation of crude oil pipelines and pump stations. Desires domestic or foreign position. Box J-513, The Oil and Gas Journal, Tulsa, Oklahoma.

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HIGHEST PRICES PAID for choice oil and gas income royalties, overrides, oil properties. A. S. Berry, P. O. Box 1383, Tulsa, Oklahoma.

SAN JUAN BASIN ROYALTY—½ undivided interest in 320 acres—Close to production in Largo Canyon Area. Mason Agency, Durango, Colorado.

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Will buy royalties or overrides on oil and gas leases. Based on competent engineering authority on reserves, will pay up to $1.50 per bbl. cash.

R. K. Shoolroy,
BOX 25,
WOOSTER, OHIO

LEASE AND DRILLING BLOCKS

TWENTY URANIUM CLAIMS embracing ore deposits testing 0.35% U_3O_8. Sell or make deal. Box J-496, The Oil and Gas Journal, Tulsa, Oklahoma.

19,700 ACRES UNDER LEASE. Selected Areas in Saline Basin. Open for Drilling Deals or Sale. Saline Basin Petroleum Co., Salina, Kansas.

CONTACT A. L. Bowles, Box 947, Ada, Okla., for Drilling Deals, Oil Production.

FOR SALE: Producing oil and gas wells and leases located in Garvin, Stephens, Kiowa Counties, Oklahoma. For details call or write, Ralph W. Shebester, Box 337, Pauls Valley, Oklahoma. Telephone 570.

OIL, GAS & URANIUM lease, 78,400 acres New Mexico. Solid tract, one owner. $1.00 per acre bonus, 50c per acre annual rentals 10 year commercial lease. Box J-418, The Oil and Gas Journal, Tulsa, Oklahoma.

3 STRIPPER LEASES, 800', 27 API, 1,000,000 bbl. estimated recoverable, eastern Kansas $30,000. Owner, Box 393, Lawrence, Kansas.

FOR SALE: 100 acre 10 year term oil and gas lease, L. C. Estes survey, Shelby County, Texas, surrounded by major company holdings and activity. Price, $5.00 per acre. Write C. A. Parker, Box 507, Center, Texas, for details.

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Producing and Nonproducing
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Inquiries Invited

B. D. BUCKLEY
6635 Delmar Ave., St. Louis, Mo.

WANTED

VENTURE CAPITAL WANTED. Financing needed for oil drilling deals in Central Oklahoma. Also want contact with investors interested in acquiring oil properties. References furnished and required. Melco Drilling Co., Box 1360, Seminole, Oklahoma.

WANTED

TO PURCHASE oil production or corporations having production for cash or stock in a listed company (or combination of both). All replies strictly confidential. Box J-412, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED

Oil companies with substantial reserves for merger or outright purchase. Interested also in large producing properties, secondary recovery prospects and large mineral holdings either productive or non-productive. Our engineers are capable of evaluating your properties on a completely confidential basis. No commissions need be paid. You deal only with the principals. Write, wire or phone LU 4-2471.

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BUSINESS OPPORTUNITIES

HAVE CAPITAL available to develop oil properties. Box J-512, The Oil and Gas Journal, Tulsa, Oklahoma.

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Sales Engineer to become Sales Manager of well established rapidly growing Equipment Manufacturing Corporation (Automatic Lease Equipment) with outstanding immediate earning potential. Will require approximately $30,000 to purchase appreciable percentage of closed corporation stock. Must be graduate accredited Engineering College in Mechanical or Petroleum Engineering with minimum six years experience designing, manufacturing, or selling oil and gas production equipment. None others need apply. Must be aggressive, reliable. Will be required to furnish best of references. Give pertinent information in first reply. All replies confidential.

Box J-504, The Oil and Gas Journal, Tulsa, Oklahoma.

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LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Santa Fe, New Mexico. Notice is hereby given that approximately 129.9 acres of land in five parcels within the known geologic structure of West Red River and the Middle Red River fields in Tillman County, Oklahoma, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 2:00 P. M., MST, June 21, 1956, when bids will be opened. Details of the lease offering, how and where to submit bids, may be obtained from the Bureau's Land Office at Santa Fe, New Mexico. J. A. DeLany, Manager.

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